S
PLANS - Gallatin
Timber Management
Region One

3

TIMBER MANAGEMENT PLAN

GALLATIN WORKING CIRCLE

GALLATIN NATIONAL FOREST

MONTANA

1959

COPY

FOREST SERVICE WASHINGTON, D. C.

Region 1 May 5, 1959

Richard E. McArdle, Chief, By

S-PLANS, R-1, Timber Management-Gallatin National Forest,
Gallatin Working Circle

The approved original of the management plan for the Gallatin Working Circle is returned. This plan was greatly improved by the addition of the changes which you submitted with your memorandum of April 15.

The addition of the tabulations showing the projected progress in development of a regulated series of age classes is a marked improvement. The explanation of the procedure for recalculating allowable cut in connection with each 10-year revision of the management plan is another desirable addition to the plan.

Copies of the enclosed review by Timber Management and of this memorandum should be studied by those who will administer the plan and should be bound in the front of each copy of the plan.

/s/ EDWARD P. CLIFF

Enclosures

COPY

FOREST SERVICE WASHINGTON, D. C.

The Record April 27, 1959

L. S. Gross, Forester

S-PLANS, R-1, Timber Management-Gallatin National Forest,
Gallatin Working Circle

The management plan for the Gallatin Working Circle covers 344 M acres of commercial forest land containing a total of 3.6 billion board feet of which 1.6 billion is sawtimber-size material, largely lodgepole pine and Douglas-fir.

The allowable annual cut developed in the plan is 20 MM feet of sawtimber-size material plus the equivalent of 24 MM feet of other products; a total of 44 MM.

The area and volume data include (but allowable cut excludes) the Hilgard area on which the regional forester has prohibited cutting and road building, pending study for possible designation as some sort of recreational area.

This plan was returned to the region for clarification and resubmitted by the region with memorandum of April 15.

This is a good plan. Allowable cut was calculated by Kemp's, Austrian, and Hanzlik's formulae and by the tabular method. As shown on page 17, the results were all quite close to each other. Control of cutting will be by volume rather than by area. The areas expected to be harvested and the manner in which this procedure is expected to aid in the development of a regulated series of age classes is shown in the tabulations on pages 51 and 52, 57 and 58, and 63 and 64. Emphasized in the plan is the consideration that larger areas will be cut during the first few decades than later. This is necessary to regenerate the considerable part of the working circle now occupied by stands past rotation age. This thought is expressed on page 17. Near the bottom of that page there is a statement, "The Kemp formula does provide a more rapid cut of area during the first one or two decades and thus aids in bringing about a more speedy depletion of overmature timber." The underscored expression is a poor way to state the case. Our main interest should be in orderly cutting of overmature stands at a rate which ties in with sustained yield. The rate is accelerated in this plan not to deplete such stands but to regenerate them. Two desirable results from this practice are utilization of the more or less decadent timber and conversion of the areas occupied by this timber from a condition of no net growth to a positive growth status. If the region reproduces this plan for distribution, I suggest that this particular paragraph be reworded.

2. Chief, U. S. Forest Service - 4/27/59

Those who administer the working circle should realize that success in achieving the result shown by the tabulations on the pages referred to above is dependent on scheduling stands for cutting as nearly as possible in the order shown in the tabulations. That is, the oldest stands should be scheduled for earliest cutting. Fires, windstorms, and other occurrences may necessitate changes in this order of cutting, but the overall objective must be kept in mind in preparing cutting budget revisions and annual plans of work.

The "Hilgard area" is discussed on pages 11 and 11a. This area, which contains some 50 M acres of commercial forest land, has been made the subject of a "stop order" by the regional forester, pending study of its classification for recreation. This means that no road building or timber cutting will be permitted in the area until final decision as to its classification has been made. The region should make sure that copies of further actions regarding this area are filed in each copy of the management plan. The inventory and allowable cut calculations were made prior to the stop order, but the summary of the plan and the allowable cut calculations have been revised so that the data are shown both with and without the Hilgard area. There is a bit of awkwardness here. For example, on page 4 the allowable cut calculation without the Hilgard area is shown to result in about 3,800 acres cutover annually; whereas, at the top of page 25, there is a statement that 4,420 acres will be cutover annually. If those who would administer the plan have a clear understanding of the situation, no confusion should result.

I recommend approval of the plan.

/s/ L. S. GROSS

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FOREST SERVICE MISSOULA, MONTANA

The Record November 25, 1958

John R. Castles, Forester /s/ John R. Castles

S-PLANS, R-1, Timber Management-Gallatin National Forest,
Gallatin Working Circle

I have reviewed the timber management plan for the Gallatin Working Circle of the Gallatin National Forest.

The working circle encompasses a total national forest, commercial forest area of 343,947 acres on which there is an inventory of 1,596,759 M b. m. (Scribner) of sawtimber and 4,059,200 cords of other products (5"-11" d. b. h.).

The inventory used in this plan meets the standards to which the present regional effort is directed. It computes to a statistical accuracy of plus or minus 6 percent for total cubic volume based on one probability.

The plan provides for an allowable cut of 24,000 M b. m. of sawtimber plus an additional 57,000 cords of other products (5"-11" d. b. h.).

The cut of 57,000 cords of other products is contingent upon utilization of all trees in cutting areas to 5" d. b. h. If this utilization standard is not met, a lesser cut will result. The forest will have to determine the cut level for whatever utilization standard is being met.

Recently, since the plan was written and after it was reviewed by the regional staff, a further problem has arisen which affects the allowable cut for this working circle.

At a meeting in late September with the Gallatin Dude Ranchers Association, forest and regional representatives agreed not to build roads or log in the area proposed by the Association as the Hilgard wilderness until a complete study has been made. The proposed Hilgard area affects a total of 144,871 acres on the Gallatin National Forest which lies across the middle of this working circle.

Affected in this so-called "Stop Order" area are 50,679 acres of nonreserved commercial forest area in national-forest ownership. The effect on the allowable cut for the working circle if this proposed area is reserved would be a reduction of 3,510 M of sawtimber and 8,750 cords of other products. If this proposed area should be reserved, a resulting allowable cut after reduction would be as follows:

Timber Type	Sawtimber, M b. m.	Other Products, Cords
LPP	14,350	43,890
DF	5,320	3,540
S-AF	820	820
Totals:	20,490	48,250

The foregoing calculations are made on the basis of applying commercial forest type area percentage reductions against the computed cuts.

Since it does not seem desirable to withhold further review and approval of this plan, I recommend that the plan be approved on the basis that the working circle be managed on an interim basis applying the foregoing reduced cuts until the wilderness or wild area study has been made and a decision is reached on whether to reserve part of it as a wilderness or wild area.

The plan indicates that lodgepole pine is the major timber type of the area. The sawmills at Belgrade and Livingston use lodgepole pine from this area. A recent application for a major sale to establish a lodgepole pine sawmill in the Hebgen area has also been made. Thus, the problem of utilizing lodgepole pine for lumber seems pretty generally to be solved in the working circle.

Probably the problem of intermingled land ownership (nearly 52,000 acres with the Northern Pacific and 36,000 acres with other private owners) and resulting management and rights-of-way procurement is the outstanding management problem here.

The spruce budworm has also caused severe growth losses and mortality in Douglas-fir. Because of the intermingled private land ownership, control action has been delayed. Future aerial spray projects for the control of the spruce budworm are dependent largely upon the necessary financial cooperation.

Another major problem in placing this working circle into production was touched on previously. This is the problem of recreational philosophy that is associated with the area in general. This problem, of course, is in large part due to the preservation philosophy fostered by adjacent Yellowstone National Park and the Dude Ranchers Association. That recreation is important to the area should not be minimized. However, the principle of multiple use of these forest resources is believed sounder than single purpose use or preservation policies. Incidentally, block clearcutting of national-forest lodgepole pine for pulpwood on the very boundaries of the park in the Hebgen District appears to have been done without complaint and has been fully accepted by the thousands of park visitors for a number of years.

In reviewing the plan, I find that the forest has followed the prescribed outline and regional guidelines in preparing the plan. In my opinion it appears technically accurate and well conceived. Therefore, I recommend that this plan be approved by the region.

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TIMBER MANAGEMENT PLAN FOR THE GALLATIN WORKING CIRCLE

GALLATIN NATIONAL FOREST

REGION ONE, MONTANA

1959

Submitted by /s/ Dallas W. Beaman (Forester), Date 10/15/58

Approved by /s/ George H. Duvendack (Forest Supervisor), Date 10/16/58

Approved by /s/ C. S. Crocker (Acting Regional Forester), Date 11/25/58

Approved by /s/ Edward P. Cliff (Acting Chief, Forest Service), Date 5/4/59
/s/ LSG

Reviewed by:

	NATIONAL FOREST ADMINISTRATION			
DIVISIONS	Regional Office		Washington Office	
	Initials	Date	Initials	Date
Timber Management	/s/ JRC AGL	11/24/58	/s/ Ira J. Mason	2/ 6/59
Recreation & Lands	/s/ EFB	10/29/58	/s/ Henry A.Harrison	12/9/58
			/s/ C. A. Joy	12/10/58
Range & Wildlife Mgt.	/s/ WWD	8/14/58	/s/ LWS	12/10/58
Watershed Management	/s/ GFC EFB	10/29/58	/s/ WLS	12/12/58
Fire Control	/s/ DRK	8/25/58	/s/ Merle S. Lowden	12/29/58
Engineering	/s/ HRW CWW	10/30/58	/s/ C. T. Sullivan	12/31/58

RESEARCH

Intermountain Forest and Range Experiment Station		Washington Office Branch of Research	
Initials	Date	Initials	Date
/s/Charles A.Wellner	10/7/58	/s/ CEO	4/23/59
/s/ EVR	10/20/58		

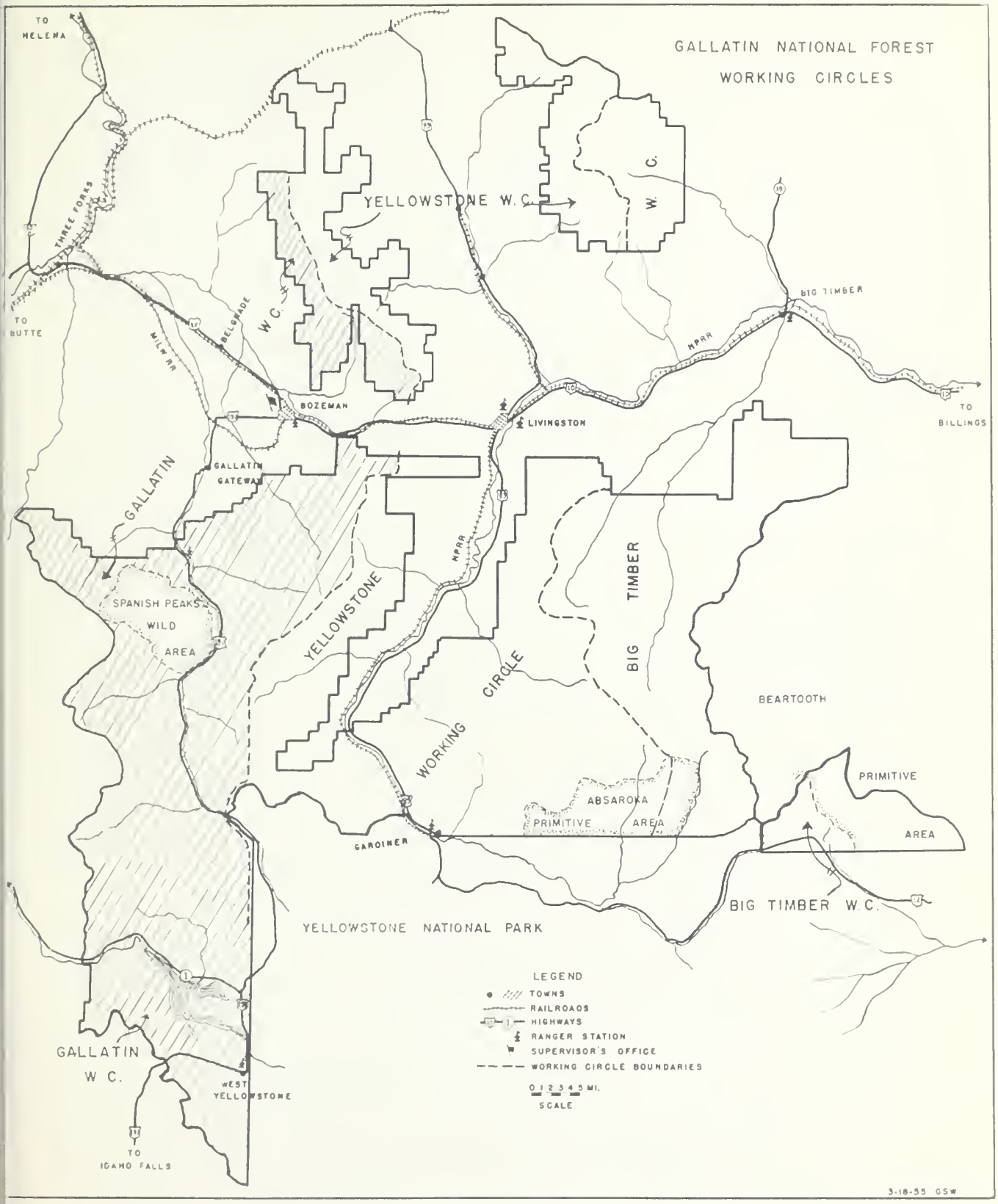
FOREWORD

Forest Service policy requires the development and application of sustained yield timber management of the national forests, working circle by working circle. It is the purpose of this plan to apply the timber management policies and objectives of national-forest administration growing out of related Federal laws and as currently set forth in the Forest Service Manual to the management of the timber resources of the national-forest lands in the Gallatin Working Circle.

This plan is primarily concerned with the nonreserved national-forest ownership, but consideration is also given to the intermingled and adjacent forest lands in other ownerships and how they influence local economy.

Basic data for the plan was obtained by timber typing on aerial photos and ground sampling for volume with the objective of obtaining an accuracy of 10 percent, plus or minus, for one probability.

The plan was written and prepared by Project Officers William Driver and Ralph McAvoy, District Rangers Edward Slusher, L. O. Peck, Howard Halpin, and Timber Management Staffman Dallas W. Beaman, under the direction of Forest Supervisor George H. Duvendack, and coordinated by Corland L. James, Forester.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C. SUMMARY OF PLAN

1. AREAS OF COMMERCIAL FOREST LAND (ACRES):

National Forest	Large Private	Other Private	State	Total
343,947	51,970	35,881	5,150	436,948

2. TOTAL TIMBER VOLUME ON COMMERCIAL FOREST LAND:

Ownership	Sawtimber (M b. m.)	Other Products (Cords)
National Forest	1,596,759	4,059,200
Large Private	251,186	540,777
Other Private	160,989	439,766
State	27,438	71,377
Total	2,036,372	5,111,120

3. ALLOWABLE ANNUAL CUT BY TIMBER TYPES, PRODUCTS, SIZE CLASS, AND AREA:

Timber Type	Annual Cut Volume: 5"-11" d. b. h. Other Products (Cords)	Annual Cut Volume: 11" + d. b. h. Sawtimber (M b. m.)	Annual Area to Cut (Acres)
	TOTAL FOR WORKING CIRCLE		
Lodgepole Pine	52,000	17,000	3,500
Douglas-fir	4,000	6,000	800
Spruce-Alpine Fir	1,000	1,000	100
Total	57,000	24,000	4,400
	REVISED ALLOWABLE CUT WITH HILGARD AREA EXCLUDED		
Lodgepole Pine	44,000	14,000	3,000
Douglas-fir	3,000	5,000	700
Spruce-Alpine Fir	1,000	1,000	100
Total	48,000	20,000	3,800

4. DATE OF REVISION: 1965

D. MANAGEMENT PLAN

1. SUMMARY OF RESULTS UNDER PREVIOUS PLANS

The original Gallatin Working Circle, consisting of the Bozeman Ranger District and the Gallatin Ranger District, was compiled in 1955, but there has never been a formal writeup made of this plan. This data is being incorporated into the present Gallatin Working Circle summary, which now includes the Hebgen District also.

In the late 1920's there was an extensive survey made of the Hebgen unit, with railroad ties being the prime product under consideration. This extensive survey data is not being considered in the present Gallatin Working Circle plan.

Prior to 1942, the volume of timber cutting on the Gallatin Working Circle is considered minor compared to the present activity. The need for a plan of management was not apparent until after World War II when the demand for products such as pulp, sawtimber, and power poles in the lodgepole pine types increased tremendously. As an illustration of the increased demand and use for forest products, the cut on the forest in 1942 was 7,161 M board feet. This cut was almost entirely in lodgepole pine species. The cut for calendar year 1957 was 21,296 M board feet.

2. LAND DESCRIPTION

The Gallatin Working Circle consists principally of the headwaters and tributaries of the Gallatin River and an area surrounding Hebgen Lake in the Madison River drainage. The working circle lies in Gallatin and Madison Counties in southwestern Montana. Bozeman, Montana, is the principal trading center. All the area lies east of the Continental Divide.

a. Boundaries

The south boundary is the Montana-Idaho State line. The east boundary is coincident with the west boundary of Yellowstone National Park and runs along the park boundary to the divide between the Gallatin and Yellowstone Rivers, thence along the divide between the Gallatin and Yellowstone Rivers in a northerly direction to the head of Jackson Creek in the Bridger Mountains, and thence northerly along the crest of the Bridger Mountains to the forest boundary on the north. The north boundary of the Gallatin Working Circle is the township line between Tps. 3 and 4 N., R. 5 E. The western boundary runs south along the Gallatin National Forest boundary to a point in Madison County where it joins the Montana-Idaho State line.

b. Subdivisions

(1) The working circle is divided into three blocks. The boundaries coincide with the three ranger districts within the working circle; i. e., the Hebgen Lake District on the south, the Bozeman District on the north, with the Gallatin District in between.

(2) Each block is subdivided into compartments. Block 5 is the Bozeman District with 17 compartments numbered in the 500 series. Block 6 is the Gallatin District with 30 compartments numbered in the 600 series. Block 7 is the Hebgen District with 39 compartments numbered in the 700 series. Some of the largest watersheds have been broken up into two or more compartments.

c. Relation to Other Working Circles

This working circle is one of the three subdivisions of the Gallatin National Forest -- the other working circles being the Yellowstone and the Big Timber. The Gallatin Working Circle was determined to be an area of manageable size bounded by logical topographic units within which adequate market opportunity is available. There is a necessity for coordinating timber harvest on the Hebgen Block with the adjacent Targhee National Forest as stumpage prices and amount of timber advertised annually are factors of mutual interest to the two forests. Most of the timber marketed locally has gone to the Idaho side. The majority of the volume cut in the past ten years consists of pulpwood which has been shipped via Union Pacific Railroad to Wisconsin pulp mills. Future development of downstream markets for lodgepole pine may require correlating the cutting budget for the Hebgen Block with the Ruby-Madison Working Circle on the Beaverhead National Forest. An example would be a pulp mill at Three Forks, Montana.

3. FOREST DESCRIPTION

With the exception of the Hebgen Block, the remaining portion of the Gallatin Working Circle is broken almost entirely by alternate section ownership. The Hebgen Block is practically continuous Federal ownership.

a. Forest Types

Commercial forest lands within the working circle extend over a wide altitudinal range all the way from the farmlands in the bottoms to subalpine conditions adjoining very rough terrain above. There are four major timber types within the working circle; i. e., lodgepole pine, Douglas-fir, spruce, and alpine fir. The type classification is based on a plurality of volume by individual species; i. e., a stand of 40 percent lodgepole pine, 30 percent spruce, and 30 percent alpine fir was classed as a lodgepole pine type.

Following is a table showing the area in acres of timber types by size classes for national-forest ownership:

Timber Type	Sawtimber	Poles	Seedlings & Saplings	Nonstocked	Total
			Acres		
Lodgepole Pine	72,127	163,475	18,919	4,352	258,873
Douglas-fir	46,195	28,866	150	1,399	76,610
Engelmann Spruce	7,352	257	-	-	7,609
Alpine Fir	626	229	-	-	855
TOTAL	126,300	192,827	19,069	5,751	343,947

For a breakdown of types and size classes for other ownerships, see the appendix.

The lodgepole pine type occupies 74.8 percent of the commercial forest lands within the working circle. It occupies a variety of sites at a wide altitudinal range. It owes its existence to fires to a very large extent. As a result, stands are almost always even-aged and quite pure in composition. Purity and even-age character tend to disappear as mature trees succumb to insect attacks and as other more tolerant species get established in the understory. Transition from lodgepole pine to some other type can be expected without management on a considerable portion of the area.

Douglas-fir type occupies 22.6 percent of the commercial forest land within the working circle. As a rule, Douglas-fir occurs on average to poor sites but will take over the best sites on occasion. The proportion of Douglas-fir increases as site becomes poor within its altitudinal range.

Spruce and Alpine fir types usually occur at high elevations on cold, wet sites where snowfall is heavy. Alpine fir will go to higher elevations than spruce and may be nearly pure on these sites. Spruce, on the other hand, may venture into creek bottoms at low elevations in limited quantities. Generally they are found together, with the predominating one determining the type designation. Other associations may be lodgepole pine, Douglas-fir, whitebark pine, and limber pine. Young stands are usually even-aged. The older they get, the more uneven-aged and patchy they become.

b. Stocking and Thrift

The thrift of the Douglas-fir throughout all the Gallatin Working Circle has been affected seriously by the infestation of the spruce budworm.

The thrift of much of the lodgepole pine is declining year by year due to overmaturity and disease--principally red rot.

See table 4 in appendix for volumes of growing stock. Also, see table on page 15 for percent of stocking by major timber types.

c. Sites

Site class measurements for each field sample were taken. From this data the following sites by types based on regional site tables are indicated:

SITE TABLE

Gallatin Working Circle

Type	Good		Medium		Poor	
	Percent	Acres	Percent	Acres	Percent	Acres
Lodgepole Pine	2	5,189	58	190,154	40	131,169
Douglas-fir	2	2,372	12	11,266	86	85,033
Engelmann Spruce	4	400	9	935	87	9,566

Tables showing a further breakdown of sites by blocks are located in the appendix.

d. Timber Quality

During the inventory of this working circle, sample growth trees were graded on each plot in accordance with Forest Survey log grades to provide information on sawtimber quality.

The following table summarizes this data:

GALLATIN NATIONAL FOREST

Gallatin Working Circle

Log Grade
Percent by Volume

Species	1	2	3	4
DF	0	12	28	60
AF	0	26	22	52
ES	0	23	67	10
LP	5	13	69	13

Additional mill studies will help to evaluate trends in timber quality and will also be helpful in preparing sound timber sale appraisals on this forest.

4. MANAGEMENT OBJECTIVES

a. Community Support

Continuity of employment, stability of communities, adequacy of administration, and intensity of present management were considered in establishing the boundary of the working circle. With the exception of the Hebgen Block, the working circle is a natural administrative unit. All lumbering activities are centered along an oiled highway that runs through the valley. All the major wood-using industries in the valley, regardless of location, can bid on timber located anywhere in the working circle. The economics of accessibility through the major developed routes of travel make this possible. Commuting time to and from the most remote corner of the working circle is short enough to prohibit the necessity of establishing additional temporary or permanent communities. The town of West Yellowstone in the Hebgen Block is supported largely by catering to the recreation public in the summer. It would benefit greatly from an industry that would maintain a yearlong population. Processing of timber could assist this community. Logging and pulpwood cutting in the past has not served this purpose. Milling may not be practical because of the severe winter and the fact that a sawmill would compound the seasonal employment problems that are already serious in the community. Keeping the railway clear of snow so that lumber could be shipped may be prohibitive in cost. The wood-using industries in the Bozeman and Belgrade areas support approximately 300 families. This amounts to an annual payroll of at least 1½ million dollars. In addition, industries make a large contribution to the local economy through taxes and purchases of supplies and services. The 25 percent return to the county from national-forest receipts is a significant contribution to the local

community. A very desirable objective is to obtain full use of lodgepole pine and other nonsawtimber trees for pulp or other products, thereby strengthening the local economy.

Although the export of pulpwood to the Lake States has represented the larger part of the recent cut of lodgepole pine in the working circle, a pulp plant located close to the source of material would be of major importance to this working circle. It is estimated that the number of men employed in the wood-using industries in and adjacent to the working circle could be increased by three times its present number by the establishment of a pulpmill in the vicinity of Three Forks, Montana.

b. Silvicultural Objectives

(1) To secure quick reproduction after removal of timber.

(2) To produce valuable species instead of those having little or no market value.

(3) To obtain full stocking and maximum yield compatible with site.

(4) To produce trees of good form and quality.

(5) To obtain the most rapid growth compatible with a full stand of good quality.

5. COORDINATION WITH OTHER USES

General

One of the guiding principles of the Forest Service has been multiple use. The principle of multiple use recognizes the desirability of developing and utilizing areas or even individual acres, for more than one purpose.

a. Recreation

The Gallatin Valley provides one of the main entrance ways to Yellowstone Park. Recreation values on this drainage are extremely high. There is an increasing desire for park visitors to camp outside the park and get away from the crowds prevalent within the park. This practice is causing a great impact on the Forest Service campgrounds located along the approach to the park.

The Gallatin Working Circle is becoming a very heavily used recreational area, and indications are that recreation users will increase rapidly in years to come. At present, there are 173 special use permits for residences along the Gallatin River and the shores of Hebgen Lake. There are 17 resorts and dude ranches within and adjacent to the working circle on private land. In addition, there are 7 resorts under special use on government land, as well as 35 improved campgrounds and 14 unimproved camp and picnic grounds. Most desirable private recreational

land along the Gallatin River and on the shores of Hebgen Lake is highly developed. Recreation visits in 1957 for the recreation areas within the working circle were estimated at 202,000. In the management of the timber in the working circle, normal harvesting procedures will be changed where recreation areas are concerned in deference to the needs of recreation as prescribed by recreational policy. Roadside timbered zones along main recreation roads and highways will be established and maintained according to regional policy. Logging in areas where recreational plans have been completed will be patterned to remove defective and high-risk trees and potential high-risk trees in the immediate vicinity of proposed improvement locations. Recreation plans have been prepared for the three ranger districts within the working circle. When approved, these plans will be used as guides in determining timber utilization and logging plan practices in areas where recreational values are involved.

Care should be exercised in using existing roads or in the construction of new roads that the use for timber harvesting does not result in elimination of other uses of the road. Standards of construction should be based on over-all use. Within the working circle there is one approved area withdrawn--the Spanish Peaks Wild Area, totaling approximately 50,000 acres, that is set aside for uses other than commercial timber production.

In addition, there is a proposal of several years' standing for the establishment of a Hilgard Wilderness or Wild Area. See map in appendix. On October 17, 1958, the regional forester wrote a letter to the Montana Wilderness Association stating that a study would be made of the proposed wilderness or wild area. It was pointed out that the boundaries on the map had no significance so far as the ultimate boundary of the recreation wilderness or wild area was concerned; the results of the study would determine the boundary. The Forest Service is interested in delineating boundaries along proper and defensible lines, and, for the time being at least, there are no pressing needs for nonrecreational developments in the area under discussion.

The stop order will affect 50,679 acres of nonreserved commercial forest area in national-forest ownership in this working circle. The effect on the allowable cut for the working circle will be a reduction of 3.5 million board feet of sawtimber and 8,750 cords of other products. The total allowable cut has been reduced this amount until a final decision is made. See plan summary.

With the aforementioned increase in recreation use within the working circle, it becomes necessary to emphasize the need for individual area recreation plans where timber sales are planned. Where recreation plans are available, they should be checked and correlated with timber sale plans prior to selling the timber to make sure that recreational values are not overlooked and destroyed.

Emphasis should be given to locating roads on the drainage face rather than in the draws. Particular attention will be given to preserving timber and aesthetic values along roads, trails, streams and the lakeshore around Hebgen Lake.

In view of the aforementioned recreation facts and estimates, it would seem unwise for the Forest Service to consider the establishment of a substantial sawmill in the Hebgen Lake area at this time.

b. Wildlife

There is a definite conflict between timber management and the Gallatin elk herd. Due to overpopulation and consequent overbrowsing, there is little or no reproduction of the commercial timber species over several thousand acres in the Upper Gallatin. There is a need for close coordination between timber management and wildlife planning for the three districts within the working circle. A reduction of the elk herd is necessary to assure that the area involved has the required amount of reproduction to produce growing stock for the working circle. Over the working circle the same conditions generally prevail in connection with deer, although to a lesser degree. However, the intensity is not so apparent because of a more widespread distribution.

The timber cutting methods in even-age management will consist of clear cutting in blocks of 10 to 50 acres in such a fashion that uncut timber areas surround the clear-cut area. This practice has several advantages in wildlife management, which include a well-rounded habitat for big game and upland game birds. These relatively small clearings surrounded by uncut timber provide a desirable combination of feed and cover for both classes of game. As time goes on, the stand of reproduction within each clear-cut area will furnish excellent wildlife cover. Experimental plots should be established on the forest to study the effective size of clear-cut areas on big game management. Timber will be preserved adjacent to streambanks. Wherever possible, roads paralleling streams will be constructed far enough from streams to permit a buffer strip of forest cover between the stream and road. The buffer strip along streams will provide shade for trout and also act as a stabilizer for the streambank. The road building program in conjunction with the increased timber utilization will provide a considerably larger area readily accessible to both hunters and fishermen. Since the harvest of game crop produced by the habitat is one of the essential phases of good game management, the building of roads will increase the volume and value of game available to the public.

c. Grazing

Grazing is one of the more important uses in this working circle. On the average, there are 3,447 head of cattle grazing approximately 32,783 animal-months each year. Out of the total gross area of 763,576 acres, there are approximately 300,000 usable acres for grazing purposes. Opening up the timber stand by cutting will increase the amount of forage available on a temporary basis. In view of the importance of grass for grazing in this unit, no attempt will be made to extend the forest beyond where it is now growing naturally. No artificial means will be used to increase the acreage of forest land at the cost of decreasing the acreage of grassland. It will be the policy to maintain the acreage of the two types of land use in status quo and concentrate more on improving the productivity of the two types of land uses on the

ground now occupied by each. Although there are many grazing problems within the working circle, there is little conflict with timber production. The clear cutting of timbered areas may bring them into increased temporary use for grazing, unless conflicts with timber reproduction develop. Beneficial and detrimental effects on livestock distribution and administration of roads constructed on sale areas should be considered. Where conflicts are probable, provision will be made for necessary cattleguards and fences in appraisals and sale contracts.

d. Mining

The working circle has a minor number of mining claims in existence. Most of these are unpatented. There is only one known conflict where mining claims are interfering with the efficient administration of the national forest, with particular reference to timber management. Surface rights under Public Law 167 were determined on the Hebgen Block during the summer of 1957. The conflict area in Mica Creek, mentioned above, was examined during the summer of 1958. Mica Creek is in the Gallatin Block.

e. Water

One of the most important contributions of national forests to the western economy is water. All national-forest lands, whether forested or open range, have important watershed values. Without the water that is stored in forested mountains that surround the Gallatin Valley, agriculture of an intensity as is practiced would be almost impossible. Water is the lifeblood of the farmers in the valley. More than 125,000 acres of farmland in the valley bottom are dependent upon an irrigation system for watering crops that would not survive with the average precipitation of 14 inches annually. Most of this falls during the off-growing season. It is estimated that 375,000 acre-feet of water are used each year to irrigate the farmland within the valley. In addition, the City of Bozeman is entirely dependent upon domestic water sources received from watershed areas within the national-forest area in the working circle.

The Hyalite Reservoir has a storage capacity of 8,027 acre-feet. Water from the Hyalite Reservoir is used for irrigation by the Middle Creek Water Users' Association and has recently been tapped for an additional water supply by the City of Bozeman. Hebgen Lake, with a storage capacity of 345,000 acre-feet, drains into the Madison River and is used for irrigation in the Beaverhead National Forest area. There is now a proposed dam on the Gallatin River near the mouth of Spanish Creek which would have a capacity of 260,000 acre-feet.

Some of the specific things that will be done to improve watershed management on timber sale and other areas are: (1) fall streamside trees which must be cut away from the stream; (2) keep logging and road building debris out of stream and out of reach of high water; (3) when building roads in and below logging areas, be sure that bridges and culverts are large enough to carry unusually high flows and so

constructed to minimize the probability of plugging with debris; (4) road grades should not restrict channels or put loose material into situations where it is likely to be carried away by running water; (5) excepted measures for preventing erosion on roads, skid trails, landings, and burns will be followed and will be specified in timber sale contracts; (6) watershed considerations dictate that marginal stands on steep slopes or poor sites are better left as protective cover; (7) peak flow measurements are needed for the purpose of estimating bridge and culvert specifications capable of handling probable discharges; (8) further research is needed to determine the local effects of timber harvest methods on streamflow and sediment yield; (9) close cooperation will be necessary between the Bozeman City Commissioners and the Forest Service in the construction of a road to Mystic Lake Reservoir. Along with this, timber cutting practices must be closely watched to maintain the highest possible quantity and quality of water in all streams on the working circle.

f. Experimental Forests

Although at present there are no experimental stations or branches within the working circle or in the lodgepole type east of the Continental Divide, it would be desirable that one be established to satisfy the increasing need for research in connection with the lodgepole pine type and the east side watershed problems. There has been serious consideration given to the establishment of a research center in Bozeman to satisfy this need.

6. REGULATION

a. Rotation and Cutting Cycles

Rotations for each type were set to agree closely with a culmination of mean annual growth in board feet. As a rule, this occurs before mortality becomes high. Rotations believed suitable for the various types are: lodgepole pine, 100 years; Douglas-fir, 140 years; spruce and alpine fir, 120 years. Because of present irregularity of age classes, many stands may have to be held well beyond these ages to allow young timber to reach suitable size for cutting. In other instances, timber may have to be cut before rotation age (usually not more than 20 years before) to avoid holding old timber unnecessarily long and to improve the age class distribution. This usually can be accomplished without trouble by advancing cutting dates for timber on the better site qualities and delaying them on the poorer sites. The determination of the length of rotation is usually dependent on four major factors: (1) economic maximum-average-volume production or age of culmination of mean annual increment; (2) silvicultural age at which the reproductive capacity is greatest and the age beyond which the disease resistance becomes less; (3) technical--maximum products of a specified size or character; (4) financial--the age or length of rotation which will give the best return on the money invested for the maximum net profit. In establishing the rotation ages for the types found on the three blocks within this working circle, the first three factors were considered. The fourth factor was given some weight, but, in the present stage of management

on national-forest lands, it is not practicable to organize a working circle for growing and harvesting timber crops solely with a view toward obtaining the greatest monetary return. Other uses, such as watershed protection, recreation, and wildlife, must be considered. Very few types of forested areas will be managed as uneven-aged stands where definite cutting cycles are established. In practically all instances better composition can be obtained by managing them as even-aged forests.

b. Growth and Mortality

Growth potentialities in this working circle are above average for the forest. On national-forest land, site qualities for lodgepole pine average medium and for other species average poor. Other ownerships compare favorably with the national-forest timber within this working circle. The spruce budworm epidemic has had a serious impact on the Douglas-fir reproduction and smaller age classes within the working circle in that growing stock has been and will continue to be reduced as long as the spruce budworm is active.

AVERAGE SITE, STOCKING, NET MEAN ANNUAL INCREMENT
AND
PRESENT MERCHANTABLE STANDS PER ACRE BY TIMBER TYPES

Timber Type	Estimated Site	Estimated Present Stocking	Present Estimated Net M.A.I.	Estimated Realizable M.A.I.	Stand Per Acre
		Percent	Per Acre	Per Acre	M
LPP	Medium	47	21.6 cu. ft.	32.2 cu. ft.	2.2 cu. ft.
DF	Poor	60	52.5 bd. ft.	140.0 bd. ft.	7.3 bd. ft.
S	Poor	52	75.2 bd. ft.	188.5 bd. ft.	9.0 bd. ft.

PERIODIC GROWTH

POLE AND SAWTIMBER STANDS

Species	Growth Per Acre Per Year* Cu. Ft.	Mortality Past 5 Years** Cu. Ft.
Spruce	46.9	21.1
Lodgepole Pine	57.7	10.6
Douglas-fir	59.7	7.2

* Based on increment samples.

** Based on plot data representing past 5-year mortality. (Plots taken 1957--remeasurement of plots will probably show an increase in Douglas-fir mortality due to spruce budworm infestation.)

In order to be ready to make the first revision of this plan, steps should be taken to improve the information about growth and mortality. Obtain information needed before the first revision of the plan as follows: (1) remeasure permanent sample plots established in this working circle; (2) make full use of current forest research reports and records; (3) establish additional permanent plots to measure net growth in uncut and cutover stands and in restocking; (4) analyze all intensive cruises made for sale preparation, for insect or disease control, or for other purposes to gain information that can be obtained on growth and mortality. The first step should be the preparation of a definite plan with a work schedule and assignment of jobs. Coordination and cooperation with the Intermountain Forest and Range Experiment Station and the Forest Insect Laboratory will be an essential part of the plan.

c. Method of Cutting

Cutting methods for the various types are outlined in the applicable marking guides for Region One contained in the appendix of this plan.

d. Growing Stock Objectives

The total volume of growing timber in the working circle constitutes the growing stock. With an overabundance of overmature timber in some timber types, the growing stock is likely to be greater than that required for normal stocking on the whole stand. The growing stock conditions can be improved as the older age classes are removed in an orderly process with the area control of cut. The following objectives will be kept in mind to improve the growing stock conditions:

1. Prevent overstocking in regenerated stands.
2. Attain a desirable distribution of age classes by harvest cuttings.
3. Restock present nonstocked and understocked areas.

e. Calculation of Allowable Cut

Three formulas; namely, the Hanzlik, Austrian, and Kemp; were used to arrive at an allowable cut and the tabular system used as a check to determine the feasibility of the cut established. Following is a table showing the results of the three formula methods and the tabular computation of allowable cut which fits the conditions of the stands the best:

Timber Type	Kemp	Austrian	Hanzlik	Tabular
	- - - - - -	- - M b. m. Sawtimber - -		- - - - - - - -
Lodgepole Pine	17,071	17,241	18,914	17,000
Douglas-fir	5,699	5,207	3,840	6,000
Spruce-Alpine Fir	1,048	1,053	612	1,000
TOTALS	23,818	23,501	23,366	24,000

As the table indicates, all three formula methods are close to each other by timber types and also in total. It is recommended that the allowable cuts as indicated by the tabular system be adopted for the first ten-year period.

In the application of the tabular method, adjustments were made in the average stand per acre in some instances, particularly in stands that will mature in the future. It seemed logical that stands of timber which will have the benefit of protection from fire and other destructive agents for a period of many years before reaching maturity will have a heavier stocking than the present mature and overmature stands.

To determine the effect of the Kemp formula on the age class distribution by area for a full rotation, calculations were made by decade for the three major timber types. The results showed that the distribution of area by ten-year age classes tends to equalize by the end of the first rotation. During the second rotation, a complete adjustment is possible in age class distribution. The study showed that the area cut over annually diminished with each successive decade until it more or less stabilized near the rate which is obtained by dividing the total commercial area by the rotation age. In all three types a pinch comes near the end of the first rotation when it is necessary to dip into the age classes below the rotation age. This can be alleviated by adjusting the area cut in the immediate previous decades.

The Kemp formula does provide a more rapid cut of area during the first one or two decades and thus aids in bringing about a more rapid adjustment of overmature timber. This is a desirable trend. Volumes that are usable now, but will not be usable in twenty years, are captured.

The allowable cuts presented and recommended provide for a moderate amount of accelerated cutting during the first ten-year period. The annual cuts will be redetermined at the end of ten years. All control of cutting is based upon volume by species.

The appendix of this plan contains the detailed computations used in determining the allowable cut and the calculations by decades of the area distribution by the application of the Kemp formula.

The following tables present the allowable cuts by volume and area, by timber types, species, and management blocks:

ALLOWABLE ANNUAL CUT BY TIMBER TYPES, PRODUCTS, SIZE CLASSES AND AREA

Timber Type	Annual Cut Volume		Annual Area to Cut (Acres)
	5"-11" d. b. h. Other Products (Cords)	11" + d. b. h. Sawtimber (M b. m.)	
- - - - - - - - - - - TOTAL FOR WORKING CIRCLE - - - - - - - - - -			
Lodgepole Pine	52,000	17,000	3,500
Douglas-fir	4,000	6,000	800
Spruce-Alpine Fir	1,000	1,000	100
Total	57,000	24,000	4,400
- - - - - REVISED ALLOWABLE CUT WITH HILGARD AREA EXCLUDED - - - - -			
Lodgepole Pine	44,000	14,000	3,000
Douglas-fir	3,000	5,000	700
Spruce-Alpine Fir	1,000	1,000	100
Total	48,000	20,000	3,800

GALLATIN WORKING CIRCLE
ALLOWABLE ANNUAL CUT BY SPECIES, TIMBER TYPE, AND PRODUCTS

Timber Type	- Species -						
	DF	S	AF	LP	WLP	ASPEN	Total
			Sawtimber - M b. m.				
Lodgepole Pine	1,400	1,600	500	13,000	500	-	17,000
			Other Products - Cords				
	2,400	1,800	2,100	45,300	400	-	52,000
			Sawtimber - M b. m.				
Douglas-fir	4,900	400	200	400	100	-	6,000
			Other Products - Cords				
	2,800	100	400	500	100	100	4,000
			Sawtimber - M b. m.				
Spruce-Alpine Fir	-	800	100	100	-	-	1,000
			Other Products - Cords				
	-	300	300	300	100	-	1,000
All Types:							
Sawtimber	6,300	2,800	800	13,500	600	-	24,000
Other Prod.	5,200	2,200	2,800	46,100	600	100	57,000

ALLOWABLE ANNUAL CUT BY SPECIES, TIMBER TYPE, AND PRODUCTS WITH HILGARD AREA OMITTED

Timber Type	- Species - DF	S	AF	LP	WLP	ASPEN	Total
			Sawtimber - M b. m.				
Lodgepole Pine	1,100	1,300	400	10,800	400	-	14,000
			Other Products - Cords				
	2,000	1,500	1,700	38,500	300	-	44,000
			Sawtimber - M b. m.				
Douglas-fir	4,100	300	200	300	100	-	5,000
			Other Products - Cords				
	2,000	100	300	400	100	100	3,000
			Sawtimber - M b. m.				
Spruce-Alpine Fir	-	800	100	100	-	-	1,000
			Other Products - Cords				
	-	300	300	300	100	-	1,000
All Types:							
Sawtimber	5,200	2,400	700	11,200	500	-	20,000
Other Prod.	4,000	1,900	2,300	39,200	500	100	48,000

GALLATIN WORKING CIRCLE
ALLOWABLE ANNUAL CUT BY BLOCKS, SPECIES, SAWTIMBER, AND OTHER PRODUCTS

Block	Product and Unit Measure	- Species - DF	S	AF	LP	WLP	ASPEN	Total
Bozeman	Sawtimber (Mb.m.)	1,000	400	100	2,200	100	-	3,800
	Other Prod. (Cds)	900	300	500	7,400	100	-	9,200
Gallatin	Sawtimber (Mb.m.)	2,900	1,300	400	5,900	300	-	10,800
	Other Prod. (Cds)	2,400	1,000	1,300	20,700	300	100	25,800
Hebgen	Sawtimber (Mb.m.)	2,400	1,100	300	5,400	200	-	9,400
	Other Prod. (Cds)	1,900	900	1,000	18,000	200	-	22,000
W. C. Total	Sawtimber (Mb.m.)	6,300	2,800	800	13,500	600	-	24,000
	Other Prod. (Cds)	5,200	2,200	2,800	46,100	600	100	57,000

ALLOWABLE ANNUAL CUT BY BLOCKS, SPECIES, SAWTIMBER, AND OTHER PRODUCTS WITH HILGARD AREA OMITTED

Block	Product and Unit Measure	Species						
		DF	S	AF	LP	WLP	ASPEN	Total
Bozeman	Sawtimber (Mb.m.)	1,000	400	100	2,200	100	-	3,800
	Other Prod. (Cds)	900	300	500	7,400	100	-	9,200
Gallatin	Sawtimber (Mb.m.)	2,300	1,100	300	4,600	300	-	8,600
	Other Prod. (Cds)	1,700	800	1,000	16,800	300	100	20,700
Hebgen	Sawtimber (Mb.m.)	1,900	900	300	4,400	100	-	7,600
	Other Prod. (Cds)	1,400	800	800	15,000	100	-	18,100
W. C. Total	Sawtimber (Mb.m.)	5,200	2,400	700	11,200	500	-	20,000
	Other Prod. (Cds)	4,000	1,900	2,300	39,200	500	100	48,000

In designating the allowable cuts by blocks on ranger districts, mature timber volumes, commercial timber area, and general accessibility were the basis for the allocation. Since this is an administrative allocation on the local level, the allowable cuts by blocks may be changed by the forest supervisor.

Control of allowable cuts will be by 5-year periods, since it is impossible to regulate closely the cut year by year. However, in order to meet the 5-year cutting requirements, the cut of timber shall not exceed the allowable cut in any one year by more than 25 percent. For any 5-year period, the cut shall not exceed the allowable cut by more than 5 percent.

Volumes from dead trees need not be charged against the allowable cut. This applies to endemic losses, such as were deducted in obtaining the net inventory used in computing the allowable cut, and does not apply to salvage obtained from catastrophic losses. The allowable cut should be recomputed as soon as possible after catastrophic losses have occurred.

Volumes from thinnings will not be regulated in the present phase of management since the amount cut in thinning is very minor at the moment. As management becomes more intensified and the demand for products from thinnings becomes greater, regulation may become necessary.

Basic requirements to sustain allowable cuts:

1. There must continue to be adequate fire control.

2. There must be adequate protection from insects and diseases. Losses from these sources will tend to decrease in the future due to the prevention of damage and the salvaging of mortality.

3. One of the principal objectives of all phases of timber management, including the access road plan, selection of sale areas, and silvicultural practices, must be to minimize losses and to increase yields. In a large measure, this will be accomplished by cutting the stand or trees most in need of cutting.

4. The allowable cuts require that practically all of the nonreserved commercial timber in the working circle must be accessible, operable, and cut over during the first rotation. This will require an adequate utilization of all wood of commercial kind, size, and quality to not less than the same standards of merchantability used in making the inventories on which the allowable cuts are based. All board-foot volumes in this plan are based on log scale, Scribner rule, and trees 11.0 inches d. b. h. and larger. All volumes for trees less than 11.0 inches d. b. h. are based on cubic-foot content.

5. The allowable cuts are also based on the principle of coordinating use and adequate protection of soil and site.

6. In addition to the above, adequate provision must be made to restock lands cut over or otherwise in need of this treatment. There must be continued and increasing productivity of the land to furnish a continuous supply of timber for the first and succeeding rotations.

In case these requirements are not met, it may be necessary to reduce the allowable cuts. If they are fully met or exceeded, it may be practical to increase the allowable cut.

f. Cutting Budget

Reference: See appendix for five-year cutting budget.

A cutting budget has been established for each ranger district on the working circle. This budget will cover a five-year period. The rangers on each district will revise the cutting budget annually by dropping a year and adding a year so that there will always be a plan for the next succeeding five years. In planning sales and setting up the cutting budget for each ranger district, three major factors are to be considered:

1. The first factor is stand condition. Those stands most in need of cutting in order to prevent obvious loss of volume from overmaturity, insects, disease, windfall, and other depredations are to be placed first on the agenda. Cutting of thrifty, mature stands should be postponed until a later date after all priority stands in need of cutting are harvested.

2. A second factor to consider is the access road availability. There are areas where the overmature condition of the timber warrants cutting the timber immediately but, due to the remoteness from any present access road, cutting will have to be postponed

until funds or other means are provided for access. Progressive planning and a program of action is needed to back up the necessity for the roads required. A five-year cutting budget and access road plan by the three blocks within the working circle is located in the appendix. The annual cut for each block is proportioned according to the total volume of mature timber available from each block. This allocation of cut in each block may be changed by the forest supervisor.

3. The third factor concerns the securing of rights-of-way across private lands. Planning procurement two or three years in advance before the date of proposed sale should be the general rule.

7. SALES POLICY

Follow the general sales policies established for the region in Chapter 2430 of the Forest Service Manual and Handbook.

a. General

(1) Conduct sales in harmony with other uses.

(2) Develop or improve the timber access road system in the working circle to the point that stands could be cut more nearly in accord with silvicultural needs and that the full allowable cut can be harvested.

(3) Provide for adequate reproduction of desirable species and make progress toward more normal distribution of growing stock.

(4) Prevent damage to residual growing stock.

(5) Control location, character, and standards of logging roads and camps established in the working circle.

(6) Whenever appropriate, K-V money will be collected for sale area betterment work, and adequate plans for its effective use will be required.

(7) Reduce all fire hazards due to logging to acceptable limits or provide extra protection for the areas involved.

b. Size of Sales

The desirability of selling natural logging chances as a unit and the requirements of potential purchasers are major factors in determining the size of sales. Both long- and short-term sales will be standard practice. A majority of the sales by number will be made on short-term basis, but, where conditions justify, the long-term sales will be made. Large sales are almost a necessity on this forest because of development requirements. After most of the forest area has been covered by initial timber sales, the trend will probably be toward smaller sales. Small sales should be offered to improve stands,

market isolated bodies of ripe timber, salvage dead or dying trees, or to meet, insofar as practicable, the special needs of purchasers.

c. Merchantability Specifications

Regional merchantability limits as stated in FSH, 2432.23, will be observed on all cutting operations. Those now in effect are:

MERCHANTABILITY SPECIFICATIONS

Tree Specifications		Product Specifications			
Species	Number Units Per Tree	Length	DIB	Net Scale in Percent of Gross Scale	Minimum Net Scale
	Logs	Feet	In.	Percent	Bd. Ft.
Lodgepole pine					
Saw logs	1	8	6	33-1/3	10
Pulpwood	1	8	4	33-1/3	0
Spruce	1	8	7	33-1/3	20
Douglas-fir	1	8	8	33-1/3	20
Alpine Fir	1	8	7	33-1/3	20
Dead timber	1	8	9	50	20

d. Logging Methods

Control of logging methods will be required on all sales to prevent damage to residual stands and the watershed and to conform with limitations imposed by other uses. Sale contracts will specify how logs are to be skidded to avoid damage to residual trees and the kind of equipment and logging methods to be used. Tractor or jammer skidding and truck hauling will be the principal methods of logging. Skid trails will be on a grade that will not produce erosion. They will not be permitted in streambeds, and streambanks will be protected. Timber will not be felled or dragged across streams or streambeds. Logging debris must be kept out of streams. Standard soil erosion requirements will be included in each sale contract. Within roadside zones and established recreation areas, salvage logging shall be conducted in a manner that will not disturb existing administrative and recreational improvements and values. Logging plans will require a felling and skidding pattern directed away from existing improvements coupled with adequate public safeguards. A strip two chains wide, requiring special treatment to protect the watershed, recreation values, and fish habitat, will be reserved on each side of a stream course.

8. FOREST DEVELOPMENT

a. Transportation

(1) Present System - At present there are no compartments within the working circle that have an adequate transportation net. In many cases a higher standard road will be required by other uses than would be needed to harvest the timber itself.

The working circle has a good basic network of main highways. Highway No. 10 bisects the north half of the working circle through Bozeman. Highway No. 191 feeds into Bozeman and Belgrade, down the Gallatin River, and into Idaho Falls, Idaho, over Targhee Pass. State Highway No. 1 bisects the Hebgen Block and feeds into Ennis and Three Forks, Montana. Forest Highway No. 40 provides a basic means of transporting timber products from the Bridger Mountain area into Bozeman.

The working circle is also provided with a good railroad net. The Northern Pacific Railroad passes through Bozeman. The Milwaukee Railroad serves Bozeman by a branch line from Three Forks. They have sidings at Gallatin Gateway and at Patterson, south of Bozeman. The Union Pacific Railroad serves West Yellowstone through Idaho. The sidings at Patterson, Gallatin Gateway, and West Yellowstone have furnished a means of loading out the pulpwood that has been cut in the working circle.

(2) Needs - As has been stated previously, none of the compartments in the working circle has an adequate transportation system at present. Following is a summary of transportation needs as shown in the 1958 transportation plan:

Miles of System Roads Approved to June 30, 1957

Satisfactory	Unsatisfactory	Nonexisting	Total Miles
39.6	161.0	178.4	379.0

Additional Planned Roads

LA Miles	LU Miles	Total Miles
587.4	1388.6	1,976.0
	Total System Miles	2,355.0

(3) Policy - Timber access roads having difficult construction or high construction costs relative to volume of timber to be moved over them in the first sale will be programed for construction with Federal funds. Land utilization roads will be constructed by the timber purchaser where practical. All roads will be constructed on location and design standards approved by the regional forester.

To avoid complications and any undue delay, rights-of-way will be obtained well in advance of advertising sales or preparing construction contracts.

(4) Program - The five-year coordinated timber harvest and access road plan in the appendix shows the roads needed during the next five-year period. This coordinated timber harvest and access road plan will be revised annually in accordance with manual instructions.

The first four projects which should be given priority in this working circle for construction from Federal funds are as follows:

Name of Road	Road No.	Mileage	Estimated Cost
1. Tamphery Creek	983	3.5	72,000
2. South Plateau	682A	6.0	78,900
3. Gallop Pass	968	6.0	85,800
4. Jackson Creek	977	5.0	71,500

b. Planting

(1) Needs - There are approximately 5,751 acres of nonstocked commercial timberland in the working circle. In addition, some 1,361 acres of young growth are poorly stocked, and annually, when the full allowable cut is reached, there will be 4,420 acres of cutover area, part of which may need planting in the rehabilitation program.

(2) Policy - Planting will be done according to the Forest Service Manual and planting handbook standards as applicable to the east side.

It is regional policy to plant timber sale areas where needed to fill in where natural stocking cannot be expected within five years after cutting. In some cases planting can also be done to improve stand composition. K-V funds are being collected and, where needed, will be used for such work in timber sale areas.

(3) Program - A planting program will be set up, with the objective to rehabilitate the nonstocked and understocked areas within the next twenty years.

As a plan of action for the program, a current cumulative record of plantable acreage will be maintained. The objective will be to build and maintain a complete file of all plantable areas, based on

intensive surveys, and to keep the data up to date by current revision as needed. Seasonal planting plans for the working circle will be made each year from the list of approved projects and in order of priorities listed therein.

c. Timber Stand Improvement

(1) Needs - Management plans with allowable cuts, felling budgets, and cutting cycles based entirely on natural growth without silvicultural aids to increase the annual and accumulative increment are almost programs of orderly liquidation. Therefore, every practical effort should be made to improve timber stands, with particular emphasis on the younger age classes.

(2) Policy - Timber stand improvement plans will be a standard part of the sales preparation work and will become a part of the sale folder. For further details on stand improvement measures, reference is made to the regional Stand Improvement Handbook as revised in 1958.

(3) Program - The objective of management should be to increase productivity of the forest land, to increase the quality and value of the products, and to increase the sustained allowable cut. One of the major means of accomplishing these objectives is through the application of stand improvement measures to immature stands. To date, no appropriated funds have been available for such measures. For the present, the major part of the stand improvement program in the Gallatin Working Circle will consist of removal of mistletoe-infected overstories and removal of small volumes of low value species, principally alpine fir. In some cases, thinnings will be undertaken where the material removed can be sold or when adequate funds are available through K-V collection procedures.

A demonstration area is planned in the Hyalite drainage which will cover cutting over a period of 10 years and a variety of management techniques. This will be arranged so that either a half-day or a full-day show-me trip can be conducted. Fact sheets will be keyed to numbered stopping points signed on the ground.

d. Insect, Disease, and Rodent Control

(1) Needs - Following this section is a more detailed description of insects and diseases which are common to the timber stands within the working circle. Other diseases or insects may be presently undetected or may appear in the future. As forest managers, we need to be constantly on the alert for any new invasion by forest destroying agents.

(2) Policy - Wherever possible, control measures will be taken against any forest destroying agent which threatens to become epidemic. However, no control measures will be undertaken without prior study and consideration being given to its effect on other

related forms of life. Neither will control measures be undertaken on a large scale without adequate preparation which will insure some measure of success.

(3) Program - Surveys will be made and kept up to date of any serious forest pest as funds are available.

Surveys have been made and control projects are now in the planning stage for control of spruce budworm by aerial spraying of DDT. For further details, see section on spruce budworm below.

Mistletoe control will be effected as a part of the sales program in mistletoe-infected areas. See section below.

Seed destroying and tree damaging rodents will be controlled by approved methods when finances are provided for such measures.

Mistletoe Infection - Mistletoe damage to lodgepole pine in the Hebgen Block of the Gallatin Working Circle can be described as heavy. It is somewhat less in the other two blocks within the working circle. Previous work in timber management on the Gallatin Forest indicates possible low emphasis being applied to mistletoe infection within the lodgepole species on the forest. With the advent of saw log industries being established within the working circle, it is becoming more and more important that we know how to control this infection to provide better quality logs for this up-and-coming industry.

The mistletoe parasite is a photophylic organism; one of the steps in the direction of its control is to maintain closed and fully stocked stands of timber. To prevent the transmission of the parasite from the older stands to the newer stands, the two generations should be separated. Cutting the old unmerchantable trees and leaving the younger unmerchantable but infected growth will not answer the purpose of control in an area of heavy infection. The removal of only the more merchantable mistletoe trees causes the parasite in the trees that are left to develop more vigorously and disperse its seed over a wider area.

Clear cutting appears to be the principal indirect method of control that can be exercised, and one of the most effective at the smallest cost. Clear-cut areas should be of a size that will reduce the amount of perimeter area of uninfected trees exposed to the surrounding infected area. Area size, however, should be determined in deference to the needs of the site and reproduction aspects in each case.

To supplement control work that can be done directly on the sale operation, it is recommended that K-V money be collected for control purposes. Infected residual trees within a cut area could be cut or poisoned. Recent work on the Targhee National Forest on spray control of mistletoe is not too encouraging. It may be, in the years to come, that K-V money can be collected and expended to aerially spray infected areas for mistletoe control.

Wood Fungus Diseases - It is the objective to operate on rotation sufficiently short so that decay loss in second growth stands will be of minor consequence. Keeping fire out of the timber will also aid materially in reducing the loss of wood volume through destruction by the fungus disease. Subsequent fire scars have provided an entrance for the wood destroying fungi.

Spruce Budworm - Spruce budworm has been present in the endemic stage in the Douglas-fir stands on the Gallatin Working Circle for many years. However, in 1942, it first began to be recognized as a potential damage factor in the Bridger Creek drainage. The history of the budworm infestation in this area is one of fluctuating severity for a period of about 10 years. During this period the infestation was reported to be confined to the Bridger Creek drainage. In 1951 the infestation spread to the western slopes of the Bridger range, and in 1952 spread to areas south of Highway No. 10. In 1954, it was reported that the infestation had spread to the fir slopes south of Bozeman and was visible in the lower Gallatin Canyon.

The aerial surveys by the Insect Laboratory showed a total of 170,000 acres infested in 1955. Aerial surveys supplemented by ground surveys in 1956 increased this acreage to 350,000 acres.

A portion of the Hebgen District Block No. 7 was selected for control action in 1957. The area involved was about 20,640 acres. This control action was carried on in conjunction with a control project on the Beaverhead National Forest. In the fall of 1957, an intensive ground survey was conducted, using the 1956 aerial survey as a starting point. A total of about 410,000 acres was recommended for control in 1958 as a result of these surveys. The infestation was found in nearly all Douglas-fir and spruce areas in the Gallatin Working Circle.

Because of the intermingled private land ownership, control action has been delayed. Future aerial spray projects for the control of the spruce budworm are dependent upon obtaining the necessary financial cooperation.

The table below shows infested acreages by years since 1949:

SPRUCE BUDWORM INFESTATION

Year	Infested Acreage	Control Action
1949	30,000	
1951	80,000	
1952	180,000	
1953	*304,500	
1954	*346,000	
1955	170,000	
1956	350,000	
1957	410,000	20,640

* Includes areas in Shields District outside of working circle.

Mountain Pine Beetle - Damage by the mountain pine beetle to the lodgepole pine type over the forest has been minor in the past. However, there was a small control measure taken in the Hebgen Block in 1956. With increasing amounts of windfall in overmature lodgepole stands in inaccessible areas, there is a possibility that we may be faced with an epidemic of mountain pine beetle in the future. When control action is necessary, the most practical method of reducing the insect population will be used.

Douglas-fir Bark Beetle - The present and past histories have indicated that the Douglas-fir bark beetle exists within the working circle in an endemic stage.

Spruce Bark Beetle - Spruce bark beetle exists within the spruce types in an endemic stage. History indicates no past outbreak of the insect.

Spruce Spider Mite - Spruce spider mite made its appearance in Region One in 1957 on areas sprayed for spruce budworm control in 1956. No spruce budworm spraying was done on this working circle in 1956.

There is no known spruce mite infestation in the Gallatin Working Circle or any part of the Gallatin National Forest at present. There is a record of an infestation in the West Yellowstone area in the early 1920's which did not become widespread.

Porcupine Control - For years the porcupine damage has been increasing within the pine types on the forest. It is regarded as serious in reproduction and advance growth stands. Control efforts should be planned and organized, outlining the extent of damage and the man-days required for control. This should be followed by inaugurating a control project if the facts indicate such need.

e. Fire Control

During the dry summer season, the forested areas of this working circle become highly inflammable. The combination of dehydrated conditions and lightning storms during this dry period of the year provides a condition for easy starting and spread of fires. The highest risk period for fire occurs in the months of July and August and frequently extends to the early part of September. Abnormal seasons have started as early as May and have extended through October.

(1) Annual Losses - An analysis of the fire history for the period from 1948 through 1957 shows a total of 161 fires. During this period 84, or 52 percent, were man-caused; 77, or 48 percent, started by lightning. Nearly all of the man-caused fires were started by recreationists of one type or another. This indicates a need for a continuous program of fire prevention education directed particularly toward the recreationist. The total acreage burned during this period was 77.78 acres, or an average of 7.8 acres per year. The average burned acreage per fire was .48 acres. See table following:

FIRE ANALYSIS - 1948-1957

Year	Total No. of Fires	Total Burned Acreage	Average Burned Acreage Per Fire	Man-caused		Lightning	
				No.	Percent	No.	Percent
1948	14	12.30	0.91	12	91	2	9
1949	22	19.19	0.91	18	92	4	8
1950	2	.21	.11			2	100
1951	6	15.11	2.52	5	83	1	17
1952	13	.98	.08	5	38	8	62
1953	24	.67	.03	11	46	13	54
1954	12	.43	.04	3	25	9	75
1955	24	6.47	.27	11	46	13	54
1956	30	18.25	.61	13	43	17	57
1957	14	4.17	.30	6	43	8	57
TOTAL	161	77.78	0.48	84	52	77	48

(2) Slash Disposal - Practically all of the cutting operations within the working circle to date have been clear cut by blocks. This is the method proposed for general use in this working circle in the future. The slash on these clear-cut blocks is dozer-piled and burned. Logging roads and skidways through these clear-cut blocks aid in breaking up the continuity of the fire hazard.

It has been the practice in the past, and will in all likelihood continue to be in the future, to lop and scatter the slash in those areas cut over for farmer products.

(3) Protection - The fire control organization of the Gallatin National Forest in the three districts involved in this working circle provides fire protection for the working circle and operates according to a detailed fire plan. The allowable annual loss for the Gallatin Working Circle is 0.12 percent for all area within the protective boundary. The actual annual average for the last ten years has been .001 of one percent for the working circle. This average annual fire loss is considered adequate for effective management of the timber resources in the working circle. As long as the average annual fire loss does not go above the forest

standard of 0.12 percent, it will be considered adequate. Should the fire loss go above this par, more intensive protection will have to be instituted.

Timber sale contracts contain clauses specifying the fire protection requirements for the operator according to the regional standards and state fire laws.

f. Acquisition

Much of the Gallatin and Bozeman Blocks is characterized by checkerboard ownership. The Northern Pacific Railroad is the principal owner. There are approximately 66,000 acres of forested lands owned by the Northern Pacific Railroad. Blocking up of these holdings by drainages or some other land division is desirable from the standpoint of timber management. For details concerning acquisition of the Northern-Pacific-owned lands by exchange, see the Gallatin acquisition plan. Small ownerships of intermirgled lands present a problem of right-of-way acquisition and, consequently, interfere with the orderly construction of timber access roads.

9. COOPERATION

a. With Other Federal Agencies

Coordinate this plan, if needed, with the Missouri Basin comprehensive agricultural program. Cooperate with the Soil Conservation Service in watershed management problems. Work with Agricultural Stabilization and Conservation Committee on A.C.P. programs as they pertain to timber management. Cooperate with any other agencies active within the working circle boundaries to the extent necessary for timber management needs.

b. With Montana State Forestry Department

Work with Montana State Forestry Department to promote sound management and wise use on all state and private lands within or adjacent to the working circle boundaries through the following cooperative programs: (1) fire control, (2) slash disposal, (3) insect and disease control, (4) cooperative forest management, (5) conservation reserve program, (6) Title IV - Tree Planting.

c. With Other State Agencies

Cooperate with the State Fish and Game Department on coordination of wildlife problems and with other state agencies having projects within or adjacent to the working circle boundaries.

Cooperate with the Montana State College in the sponsorship of research studies in timber management practices or related problems.

d. With Private Organizations

(1) Cooperate with local sportsmen's organizations on fish and game management.

(2) Cooperate with established recreational organizations.

(3) Cooperate with local chambers of commerce on access road development in creating and in sustaining local industry.

(4) Hold public hearings on controversial timber management problems and acquaint interested parties with the Forest Service plans, practices, and policies.

10. OPERATION OF PLAN

a. Annual Plans

Annual plans will be made for the purpose of putting the plan to work on the ground. Access road development will have to be coordinated with the cutting budget. Timber surveys and timber sales stem directly from the cutting budget. Annual plans will be made to coordinate these activities with the guiding principles set forth in the main plan.

Other annual plans that will be prepared are planting plans and stand improvement and sale area betterment plans.

b. Control Records

Control records will consist of tables and maps recording the following:

(1) Records of timber sales will consist of name of purchaser, date, stumpage price by species, the market supplied, kind of products, and location by compartment and legal description.

(2) Cutting budget records will show the actual cut by species as compared with budgeted amount, volume estimated, and volume sold. The data is to be segregated by compartments, legal subdivision, drainage, and year. Salvage cuttings will be segregated from the planned cuttings.

(3) Planting record will show dates of establishment, species, age class planted, and survival record.

(4) Intensive survey records will show detailed locations, acreage, date and other pertinent information.

(5) Map showing location of compartments in working circle.

(6) Ownership map.

(7) Timber type map.

(8) Transportation plan map.

(9) Budgeted area map, with a color code and legend, showing compartments budgeted for cutting stands most urgently in need of cutting.

(10) Sold area map indicating area sold.

(11) Cut area map showing area of regulated and unregulated types cut.

E. SUPPORTING DATA

1. HISTORY

For the purpose of this portion of the plan, the working circle has been divided into two areas; namely, the Gallatin Valley and the Madison Basin, or Hebgen area.

Since the establishment of the first sawmill in the valley, the timber and logging industry has played an important part in the development of the Gallatin Valley.

Through the early period of settlement and before timber management practices or controls were in effect, the forested areas were a source of free stumpage for the young and thriving timber industry.

The first commercial cuttings were in 1864, adjacent to a water power sawmill near Spring Hill on the west slopes of the Bridgers.

Later, in 1870, a water-powered saw and shingle mill was established on Little Bear Creek southeast of Gallatin Gateway.

During the 1870's the first steam-powered mill was introduced into the valley. Three such mills were operated by the soldiers from Fort Ellis. These were located in the Bridger Canyon. Another water-power mill was established near the mouth of Hyalite Canyon in 1878. The logs to supply this mill were cut in History Rock drainage and driven down Hyalite Creek or "Middle Creek." Cutting was also done in Gallatin Canyon, and the logs were floated down the river to a water-powered mill located at "Tie Town" near what is now Gallatin Gateway.

The first extensive timber operation was started in 1883 to provide ties for the Northern Pacific Railroad as it was built across the valley and westward. The ties were cut up the Gallatin Canyon and floated down to "Tie Town."

Around 1900 two important changes came to the timber industry in the Gallatin Valley: One was the establishment of the Forest Reserve; the other was the establishment of an industry that shipped forest products out of the valley. The first timber sold by the Forest Reserve was from a sale for 268 M located on Wildhorse Creek in Hyalite Canyon.

In 1902 Mr. Walter Cooper began a large-scale lumber and tie operation. The products of this operation were shipped for the use of Chicago, Burlington, and Quincy Railroad. Part of the timber was cut in Bear Canyon and was transported to railhead down a 9.6-mile wooden flume. Other timber was cut mainly in West Fork, Beaver Creek, and Taylor Fork in the Upper Gallatin. This timber was moved down the river on "high water" drives to Central Park. Much of this cutting was done on Northern Pacific and other private lands.

Cooper's operation reached its peak in 1905 when 10,450 M board feet of ties and lumber were produced. A strike at "high water time" in 1906 crippled the Gallatin operations and caused them to fold up in 1907. He continued to operate on a small scale in Bear Canyon until 1913.

The timber industry continued on a small scale, mostly supplying a continued local demand, until 1945 when the Idaho Pole Company established a pole-treating plant at Bozeman. Also, the Corcoran Pulpwood Company became interested in the lodgepole timber in and around the Gallatin Valley. The first two pole sales were in Buckskin Creek and Face Draw units of Hyalite Canyon and totaled 48,000 poles. The first pulpwood sale to Corcoran Pulpwood Company was in the Hyalite area also and for 56,700 cords.

Operations of these two companies increased through 1956 when the pulpwood operations tapered off and ceased as far as the Gallatin area was concerned. The operations of the pole company have continued stable to this date. The establishment of a modern, high production, electric powered, lumber mill at Belgrade in 1954 by the Yellowstone Pine Company provided an increased and continuing demand for timber. The production of Yellowstone Pine in 1955 was 11,000 M board feet and increased to 13,500 M in 1957. This mill promises to contribute considerably to the stability of the forest products industry of the Gallatin Valley.

The early history of the Hebgen area is not too well known. Timber products were used by the early settlers in this area in the form of house logs, fuel-wood, and other building materials. A tie cutting operation began in 1921 and continued through 1935. During this time it is estimated that about 2,000,000 ties were cut and removed by the Globe Timber Company.

The Montana and Idaho Lumber Company operated in the Hebgen area intermittently from 1936 to 1954. They produced saw logs, power poles, and miscellaneous products. Their operations were generally small and did not contribute too much to the economy of the area. It has been estimated that their total cut for the entire period of operations was about 16,500 M board feet. They are not now operating in the Hebgen area, although they are still in operation in Rexburg, Idaho.

Another important phase in the utilization of timber in the Hebgen area began in 1950 when Charles J. Ericson and Son began a pulpwood operation. The pulpwood is shipped via Union Pacific Railway to Thilmany Pulp and Paper Company in Wisconsin. This company has been operating mostly in areas cut over in the tie operation. It has permitted economical cleanup through clear cutting and the establishment of a new stand on these areas. The pulp cutting operation was seriously reduced in 1957. There have been about 73,000 cords of material removed during the period of operations to date.

2. PHYSIOGRAPHY

a. Topography

There are four mountain ranges within the Gallatin Working Circle. These are the Bridger Range in the northern portion, the Gallatin Range on the east side, the Madison Range on the west side, and the northern slopes of the Henrys Lake Mountains on the south end of the working circle. The principal watersheds are the East Gallatin, West Gallatin, and Madison Rivers.

The topography varies from flat and rolling terrain in the fertile valley bottoms to sharp ridges with some plateaus at the higher elevations. The side drainages consist usually of long creeks which fan out into broad, elongated or semi-circular basins at the heads.

The elevations within the working circle range from 5,000 feet near Bozeman to 9,600 feet in the Bridger Range, 10,000 feet in the Gallatin Range, and 11,000 feet in the Madison Range. The highest point in the working circle is Koch Peak which is 11,293 feet above sea level. The elevational range of commercial timber is from 5,500 to 7,500 feet.

The principal rock formations are limestone in the Bridger Range, gneiss in the Gallatin Range, and metamorphic sandstone in the Madison Range. There are some shale formations in the Rock Canyon and Meadow Creek areas. There are some deposits of low grade coal in the Meadow Creek drainage from which coke was produced. The remains of the coke ovens can still be seen in this area. Sandstone formations are present in some parts of the working circle also.

b. Soils

The principal parent material for the major portion of the agricultural soils in the Gallatin Valley is a volcanic ash or dust which was windblown, and it settled in and around the lake which formerly occupied much of the valley proper. In some places this volcanic ash reaches a depth of 2,000 feet. The soils vary from a silty loam in the valley bottom to coarse, gravelly, and stony soils in the higher elevations.

The soil formation of the West Yellowstone Flat is unique to the working circle. It consists of an obsidian sand which is highly permeable and does not retain soil moisture. This has been a deciding factor in attempting to re-establish reproduction on these flats. An excellent crop of seedlings will sprout in the spring but usually fail to survive the dry summer period.

Soils and climate in the Bridger portion of the working circle are such that they permit only a poor to fair rate of growth of commercial timber. However, the rate of growth in the Gallatin drainage is fair to good.

Topography in general will permit the construction of a well-planned road network to harvest the timber. Winter logging chances can be segregated from summer chances and timber sales regulated accordingly.

c. Climate

The climate of the Gallatin Valley in general is similar to that of other intermountain valleys in the northwest. It is continental in character and is subject to wide extremes of seasonal and daily temperatures; a difference of 30° F. sometimes occurring in 24 hours' time. Winds are variable in both movement and direction. In the daytime the prevailing winds are generally from the southwest or west. At night they very often shift to the southeast. Locally some of the coldest winds in the winter are from the east. During the winter warm "chinook" winds also occur, and at times the snow suddenly disappears by direct evaporation.

The mean annual temperature in the Bozeman area is approximately 42° F. Temperatures vary from 35° to 105°. Extreme periods of cold weather (-20° to -30°) are seldom of a week's duration. However, in the West Yellowstone area the temperatures average somewhat below that of the Bozeman area, and long periods of extreme cold occur quite frequently. The frost-free period is usually from late May to the middle of September, for an average of 114 days.

Snowfall averages about 70 inches, with the greatest amount occurring during the months of December, January, and March. Thus, the accumulated snow depth is greatest during the 3 months of January, February, and March.

Average annual precipitation for the Gallatin area is about 18 inches, with the greatest amounts falling during May and June.

The average "breakup" period, as far as logging is concerned, is about two to two-and-a-half months duration.

3. ECONOMY

The Gallatin Valley is operating on a well established agricultural economy. Cattle ranching, irrigated farming, and dairy farming are well established in the valley. The principal source of income for the Hebgen Lake area is the tourist trade. Forest industries in recent years have become an integral part of the economy of the Gallatin Working Circle.

The forest industries are centered in Bozeman, population 12,000; Belgrade, population 750; and Gallatin Gateway, population 200. There are small mills located in Manhattan and West Yellowstone. West Yellowstone has been the center of a pulp-cutting operation for the past seven years. However, it is not certain how long this operation will continue. It is hampered by high freight rates to Wisconsin pulp mills where the material is presently being sent for processing.

Following is the number of processing plants operating in the Gallatin Working Circle and utilizing national-forest timber for a major portion of their operations:

Number	Location	Annual Production M b.m.
1	Belgrade	16,000 M
1	Bozeman	4,000 M
1	Bozeman (poles)	2,250 M
1	Belgrade	1,000 M
1	Manhattan	1,000 M
4	Gallatin Gateway	500 M
1	Bozeman	250 M
3	West Yellowstone	75 M
3	Bozeman	50 M

Total milling capacity of the working circle is about 27,000 M.

Much of the timber in this working circle has been sold as pulpwood since 1946. However, pulpwood sales have been considerably reduced in the past two years due to high freight rates and reduced demand by Wisconsin mills. The establishment of a pulp mill in the vicinity of Three Forks would be a boon to the forest industry of this area. It would permit the utilization of much of the material now wasted in the woods and in the milling process.

There is a necessity for increased utilization capacity if the total allowable cut is to be utilized. This can come about by expansion of established industries, which is unlikely, or the establishment of new manufacturing plants. Renewal of pulpwood operations would solve part of this problem.

APPENDIX

GALLATIN WORKING CIRCLE

TIMBER MANAGEMENT PLAN

INVENTORY TECHNIQUE AND ACCURACY

Data for the inventory of this plan are based on instructions issued by Region One in 1955 and 1956, and on Field Instructions for Forest Inventory prepared by the Intermountain Forest and Range Experiment Station. In brief, the technique involved was:

1. Aerial photointerpretation of the various strata (condition class and species types).

2. On-the-ground checking of these classifications.

3. Transfer of strata classification to a two-inch-to-a-mile planimetric map.

4. Area calculation by strata.

5. Sampling each important strata (5,000 acres or more) to established standards.

6. Testing the statistical accuracy of the data.

RELIABILITY OF THE DATA

In determining the volume and acreage of the various cover types (strata) there are two sources of error:

1. Technique errors in measuring, recording, and compiling sample plot, acreage, and volume data. These errors were minimized by training and checking of individuals responsible for the field and office work.

2. Sampling errors which are theoretical measurements of the reliability of the estimates based on the variability exhibited by the sample. If time and money were not limiting factors, every tree could be measured, and sampling errors would be reduced to zero. However, time and money are limiting factors, and guidelines have been established by the region so that the various strata by working circles would be sampled on about the same intensity. The Gallatin Working Circle has an over-all cubic volume sampling error of $\pm$ 6 percent two times out of three. This is well within the $\pm$ 10 percent minimum set up by the memorandum of March 6, 1956.

The field data on the Hebgen Block were collected by Ralph T. McAvoy, Timber Management Planner on the Gallatin National Forest, with the aid of trained assistants. The field inventory on the Bozeman and Gallatin Blocks was taken by district personnel assigned to those districts and compiled by assistant rangers detailed to the supervisor's office.

GALLATIN WORKING CIRCLE

HEBGEN BLOCK

Cull percentage used to convert gross partial cubic foot volume to net partial cubic foot volume:

Douglas-fir, spruce, and aspen	3 percent
Lodgepole, alpine fir, whitebark or limber pine	5 percent

This is roughly equivalent to a board-foot basis of 6 percent and 10 percent.

Conversion factors used to convert net partial cubic foot sawtimber-sized trees to net board foot Scribner:

Douglas-fir and spruce	4.8
Lodgepole pine, alpine fir, whitebark or limber pine, and aspen	4.4

These above factors and figures are based on Forest Survey information, Block 2, eastern Montana.

Statistical accuracy and the coefficient of variation for the major types in the Hebgen Block are as follows:

	Coefficient of Variation	Sampling Error
	- - - - - - - - Percent - - - - - - - -	
D9M	38	12
D9P	29	17
S9M&P	34	17
LP8W	61	15
LP8M	86	30
LP8P	88	39

The sampling error for the total volume for the Hebgen Block is plus or minus 10 percent based on one probability.

TABLE 1 - LAND AREA BY OWNERSHIP AND MAJOR CLASSES OF FOREST LAND

Class of Land	Ownership by Acres				Total
	National Forest	Large Private	Other Private	State	
FOREST LAND					
Nonreserved					
Commercial	343,947	51,970	35,881	5,150	436,948
Noncommercial	157,812	29,322	7,850	840	195,824
Reserved					
Commercial	15,362	140	-	-	15,502
Noncommercial	23,083	380	-	-	23,463
TOTAL FOREST LAND	540,205	81,812	43,731	5,990	671,737
NONFOREST LAND					
Nonreserved	96,039	9,445	23,024	2,296	130,804
Reserved	11,366	244	-	-	11,610
TOTAL LAND AREA	647,609	91,501	66,755	8,286	814,151

TABLE 2 - COMMERCIAL FOREST LAND BY OWNERSHIP, TYPE, AND STAND-SIZE CLASS

Type and Ownership Class	Stand-size and Condition Class				
	Sawtimber	Pole	Seedling Sapling	Nonstocked	Total
Lodgepole Pine					
a. National Forest	72,127	163,475	18,919	4,352	258,873
b. Large Private	17,294	13,220	4,017	443	34,974
c. Other Private	11,160	14,246	2,360	327	28,093
d. State	2,598	1,721	235	18	4,572
TYPE TOTAL	103,179	192,662	25,531	5,140	326,512
Douglas-fir					
a. National Forest	46,195	28,866	150	1,399	76,610
b. Large Private	9,402	4,395	-	491	14,288
c. Other Private	2,035	5,055	-	105	7,195
d. State	165	413	-	-	578
TYPE TOTAL	57,797	38,729	150	1,995	98,671
Engelmann Spruce					
a. National Forest	7,352	257	-	-	7,609
b. Large Private	2,705	3	-	-	2,708
c. Other Private	584	-	-	-	584
d. State	-	-	-	-	-
TYPE TOTAL	10,641	260	-	-	10,901
Alpine Fir					
a. National Forest	626	229	-	-	855
b. Large Private	-	-	-	-	-
c. Other Private	-	9	-	-	9
d. State	-	-	-	-	-
TYPE TOTAL	626	238	-	-	864
GRAND TOTAL ALL TYPES AND OWNERSHIPS	172,243	231,889	25,681	7,135	436,948

TABLE 3 - VOLUME OF LIVE SAWTIMBER BY SPECIES, STAND-SIZE, AND OWNERSHIP

Thousands of Board Feet - Scribner

Stand-size and Ownership	Species						Total
	Douglas-fir	Engelmann Spruce	Alpine Fir	Lodgepole Pine	Whitebark & Limber Pine	Aspen	
Sawtimber							
a. National Forest	325,751	133,879	28,588	502,179	10,851	1,403	1,002,651
b. Large Private	68,802	36,982	4,970	113,235	3,040	162	227,191
c. Other Private	24,201	15,518	3,544	87,167	1,301	11	131,742
d. State	2,569	2,264	739	18,453	284	16	24,325
Pole							
a. National Forest	79,184	47,548	16,184	420,684	30,508	-	594,108
b. Large Private	9,864	2,543	313	10,999	276	-	23,995
c. Other Private	11,534	3,159	418	13,754	382	-	29,247
d. State	1,090	415	37	1,537	34	-	3,113
Total All Stands by Ownership							
a. National Forest	404,935	181,427	44,772	922,863	41,359	1,403	1,596,759
b. Large Private	78,666	39,525	5,283	124,234	3,316	162	251,186
c. Other Private	35,735	18,677	3,962	100,921	1,683	11	160,989
d. State	3,659	2,679	776	19,990	318	16	27,438
TOTAL ALL STANDS AND ALL OWNERSHIPS	522,995	242,308	54,793	1,168,008	46,676	1,592	2,036,372

TABLE 4 - VOLUME OF PRIMARY GROWING STOCK BY SPECIES, STAND-SIZE, AND OWNERSHIP

Thousands of Cubic Feet

Stand-size and Ownership	Species						
	Douglas-fir	Engelmann Spruce	Alpine Fir	Lodgepole Pine	Whitebark & Limber Pine	Aspen	Total
Sawtimber							
a. National Forest	89,684	38,035	10,045	204,460	9,839	349	352,412
b. Large Private	17,641	24,488	1,169	27,053	801	45	71,197
c. Other Private	8,077	4,002	879	22,152	391	15	35,516
d. State	3,116	1,052	92	6,162	9		10,431
Pole							
a. National Forest	43,474	13,760	17,167	286,414	3,848	665	365,328
b. Large Private	7,788	2,352	2,381	35,083	963	103	48,670
c. Other Private	5,268	1,622	1,615	30,436	608	30	39,579
d. State	988	1,017	492	3,895	30	2	6,424
Total All Stands by Ownership							
a. National Forest	133,158	51,795	27,212	490,874	13,687	1,014	717,740
b. Large Private	25,429	26,840	3,550	62,136	1,764	148	119,867
c. Other Private	13,345	5,624	2,494	52,588	999	45	75,095
d. State	4,104	2,069	584	10,057	39	2	16,855
TOTAL ALL STANDS AND ALL OWNERSHIPS	176,036	86,328	33,840	615,655	16,489	1,209	929,557

TABLE 5 - TIMBER VOLUME ON COMMERCIAL FOREST LAND

Nonreserved - National Forest Only

Timber Type	Sawtimber Volume 11" d.b.h. & Over Scribner Dec. C	Cubic Volume			Dead Salvage Material	Usable Volume From Green Cull Trees
		Poles	Sawtimber	Total		
	- M b.m. -	- Thousands of Cubic Feet -			- - Cords - -	
Lodgepole Pine	1,163,498	320,556	257,202	577,758	282,003	175,163
Douglas-fir	363,150	38,552	80,393	118,945	36,089	41,642
Spruce	67,066	5,418	14,140	19,558	10,491	11,431
Alpine Fir	3,045	802	677	1,479	-	-
TOTAL	1,596,759	365,328	352,412	717,740	328,583	228,236

TABLE 6 - SITE TABLE

Type	Good		Medium		Poor	
	Percent	Acres	Percent	Acres	Percent	Acres
Lodgepole Pine	2	5,189	58	190,154	40	131,169
Douglas-fir	2	2,372	12	11,266	86	85,033
Engelmann Spruce	4	400	9	935	87	9,566

TABLE 7 - ALLOWABLE CUT CALCULATIONS

LODGEPOLE PINE TYPE

KEMP FORMULA

$$Ac = \frac{1Ar + 3As + 5Ap + 7Am}{4R}$$

Ar = Restocking	4,352
As = Seedlings & saplings	18,919
Ap = Poles	163,475
Am = Sawtimber	72,127
Total	258,873

R = 100

$$\text{Annual cut area} = \frac{(1 \times 4,352) + (3 \times 18,919) + (5 \times 163,475) + (7 \times 72,127)}{4 \times 100}$$

$$= \frac{4,352 + 56,757 + 817,375 + 504,889}{400}$$

$$= \frac{1,383,373}{400}$$

$$= 3,458 \text{ acres}$$

CALCULATION OF ALLOWABLE CUT BY SPECIES AND PRODUCTS

	Species						
	D	S	AF	LP	WBLP	ASPEN	TOTAL
	- -	- - - -	- - -	Sawtimber	- - - -	- - - - -	
Stand per Acre (M b.m.)	0.398	0.454	0.138	3.790	0.155	0.002	4.937
Allowable Cut (M b.m.)	1,376	1,570	477	13,106	536	7	17,071
	- -	- - - -	- -	Other Products	- - - -	- - - -	
Stand per Acre (cu. ft.)	61.9	46.9	54.8	1,185.8	11.0	0.3	1,360.7
Allowable Cut (M cu. ft.)	214.0	162.2	189.5	4,100.5	38.0	1.0	4,705.2
Allowable Cut (cords)	2,377	1,802	2,105	45,561	422	11	52,278

TABLE 7 - ALLOWABLE CUT CALCULATIONS
(Cont'd)

LODGEPOLE PINE TYPE

AUSTRIAN FORMULA

$$Ac = I \pm \frac{Va - Vd}{R}$$

I = 5,592 M cu. ft.

Va = 577,758 M cu. ft.

R = 100

Vd = 293,821

Computation of Vd:

Age	Normal Yield	
20	-	
40	410	
60	2,000	
80	3,400	
100	2,300	($\frac{1}{2}$ x 4,600)
	8,110	

8,110 x 70 = 5,677

5,677 x 20 = 113,540

113,540 ÷ 100 = 1.135 M cu. ft. per acre

1.135 x 258,873 = 293,821 M cu. ft.

$$Ac = 5,592 \pm \frac{577,758 - 293,821}{100}$$

$$= 5,592 + \frac{283,937}{100}$$

$$= 5,592 + 2839$$

= 8,431 M cu. ft. or 94,000 cords

TABLE 7 - ALLOWABLE CUT CALCULATIONS
(Cont'd)

LODGEPOLE PINE TYPE

HANZLIK FORMULA

$$Ac = \frac{Vm}{R} + I$$

Vm = 577,758

R = 100

I = 186,746 x 21.6 = 4,034 M cu. ft.

$$Ac = \frac{577,758}{100} + 4,034$$

= 5,777 + 4,034 = 9,811 M cu. ft.
or 109,000 cords

LODGEPOLE PINE TYPE

ALLOWABLE ANNUAL CUT - 17,000 M

Current Age	Age When Cut	Area Acres	Stand per Acre	Total Volume	Years to Cut	
					Each	Cumulative
200+	200+	11,309	6.6	74,639	4	4
161-200	190	16,963	6.6	111,956	7	11
141-160	170	28,037	6.6	185,044	11	22
121-140	160	22,382	6.6	147,721	9	31
101-120	140	11,309	6.6	74,639	4	35
81-100	130	16,728	6.6	110,405	6	41
61- 80	120	72,801	6.6	480,487	28	69
41- 60	120	50,419	6.6	332,765	19	88
21- 40	120	5,654	6.6	37,316	2	90
0- 20	100	23,271	6.6	153,589	9	99

LODGEPOLE PINE TYPE - GALLATIN WORKING CIRCLE
PROGRESS OF REGULATION BY AREA BY APPLICATION OF KEMP FORMULA
BY TEN-YEAR PERIODS

Period	Age Classes									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
1st	23,271	-	2,827	2,827	25,209	25,210	36,400	36,401	8,364	8,364
2nd	34,580	23,271	-	2,827	2,827	25,209	25,210	36,400	36,401	8,364
3rd	31,060	34,580	23,271	-	2,827	2,827	25,209	25,210	36,400	36,401
4th	26,090	31,060	34,580	23,271	-	2,827	2,827	25,209	25,210	36,400
5th	29,690	26,090	31,060	34,580	23,271	-	2,827	2,827	25,209	25,210
6th	27,810	29,690	26,090	31,060	34,580	23,271	-	2,827	2,827	25,209
7th	27,540	27,810	29,690	26,090	31,060	34,580	23,271	-	2,827	2,827
8th	26,670	27,540	27,810	29,690	26,090	31,060	34,580	23,271	-	2,827
9th	25,740	26,670	27,540	27,810	29,690	26,090	31,060	34,580	23,271 17,958	-
10th	24,380	25,740	26,670	27,540	27,810	29,690	26,090	31,060	34,580 19,387	5,313 5,313
	24,700	24,380	25,740	26,670	27,540	27,810	29,690	26,090	31,060	15,193

Age Classes											Total Cut
101-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	200+	10-Yr. Period
5,654	5,655	11,191	11,191	14,018	14,019	2,827	2,827	5,654	5,655	11,309	
					6,308	2,827	2,827	5,654	5,655	11,309	34,580
8,364	5,654	5,655	11,191	11,191	14,018	7,711					
				9,331	14,018	7,711					31,060
8,364	8,364	5,654	5,655	11,191	1,860						
	1,730	5,654	5,655	11,191	1,860						26,090
36,401	8,364	6,634									
14,692	8,364	6,634									29,690
36,400	21,709										
6,101	21,709										27,810
25,210	30,299										
	27,540										27,540
25,209	25,210	2,759									
	23,911	2,759									26,670
2,827	25,209	1,299									
	24,441	1,299									25,740
2,827	2,827	768									
2,827	2,827	768									24,380
											24,700

TABLE 7 - ALLOWABLE CUT CALCULATIONS
(Cont'd)

DOUGLAS-FIR TYPE

KEMP FORMULA

$$Ac = \frac{1Ar + 3As + 5Ap + 7Am}{4R}$$

Ar = Restocking	1,399
As = Seedlings & saplings	150
Ap = Poles	28,866
Am = Sawtimber	46,195
Total	76,610

R = 140

$$\text{Annual cut area} = \frac{(1 \times 1{,}399) + (3 \times 150) + (5 \times 28{,}866) + (7 \times 46{,}195)}{4 \times 140}$$

$$= \frac{1{,}399 + 450 + 144{,}330 + 323{,}365}{560}$$

$$= \frac{469{,}544}{560}$$

= 838 acres cut over annually

CALCULATION OF ALLOWABLE CUT BY SPECIES AND PRODUCTS

	Species						
	D	S	AF	LP	WBLP	ASPEN	TOTAL
				Sawtimber			
Stand per Acre (M b.m.)	5.701	0.426	0.189	0.409	0.060	0.017	6.802
Allowable Cut (M b.m.)	4,777	357	158	343	50	14	5,699
				Other Products			
Stand per Acre (cu. ft.)	318.5	11.0	46.4	59.5	10.5	12.1	458.0
Allowable Cut (M cu. ft.)	266.9	9.2	38.9	49.9	8.8	10.1	383.8
Allowable Cut (cords)	2,965	102	432	554	98	112	4,263

TABLE 7 - ALLOWABLE CUT CALCULATIONS
(Cont'd)

DOUGLAS-FIR TYPE

AUSTRIAN FORMULA

$$Ac = I \pm \frac{Va - Vd}{R}$$

I = 52.5 x 76,610 = 4,022 M b.m.

Va = 345,150 M b.f.

R = 140

Vd = 605,219

Computation for Vd:

POOR SITE

Age	Normal Yield
20	0
40	0
60	50
80	2,150
100	5,080
120	8,640
140 ($\frac{1}{2}$)	6,475
TOTAL	23,395

70% x 23,395 = 16,376
16,376 x 20 = 327,520
327,520 ÷ 140 = 2.339 M b.f.
2.339 x 76,610 = 179,190 M b.f.

$$Ac = 4,022 \pm \frac{345,150 - 179,190}{140}$$

= 4,022 + 1,185
= 5,207 M b.f.

TABLE 7 - ALLOWABLE CUT CALCULATIONS
(Cont'd)

DOUGLAS-FIR TYPE

HANZLIK FORMULA

$$Ac = \frac{Vm}{R} + I$$

Vm = 314,297

R = 140

I = 30,409 x 52.5 = 1,596 M b.f.

$$Ac = \frac{314,297}{140} + 1,596$$

$$= 2,244 + 1,596$$

$$= 3,840 \text{ M b.f.}$$

DOUGLAS-FIR TYPE

ALLOWABLE ANNUAL CUT - 6,000 M

Current Age	Age When Cut	Area Acres	Stand per Acre	Total Volume	Years to Cut	
					Each	Cumulative
200+	200+	4,055	8.0	32,440	5	5
161-200	190	6,305	8.0	50,440	8	13
141-160	170	10,433	9.0	93,897	16	29
121-140	170	12,535	9.0	112,815	19	48
101-120	160	12,535	10.0	125,350	21	69
81-100	160	6,230	10.0	62,300	10	79
61- 80	160	10,433	12.0	125,196	21	100
41- 60	160	12,535	12.0	150,420	25	125
21- 40	-	-	-	-	-	-
0- 20	140	1,549	14.0	21,686	4	129

DOUGLAS-FIR TYPE - GALLATIN WORKING CIRCLE
PROGRESS OF REGULATION BY AREA BY APPLICATION OF KEMP FORMULA
BY TEN-YEAR PERIODS

Period	Age Classes									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
1st	1,549	-	-	-	6,267	6,268	5,216	5,217	3,115	3,115
2nd	8,380	1,549	-	-	-	6,267	6,268	5,216	5,217	3,115
3rd	7,520	8,380	1,549	-	-	-	6,267	6,268	5,216	5,217
4th	7,130	7,520	8,380	1,549	-	-	-	6,267	6,268	5,216
5th	6,750	7,130	7,520	8,380	1,549	-	-	-	6,267	6,268
6th	6,470	6,750	7,130	7,520	8,380	1,549	-	-	-	6,267
7th	6,260	6,470	6,750	7,130	7,520	8,380	1,549	-	-	-
8th	6,340	6,260	6,470	6,750	7,130	7,520	8,380	1,549	-	-
9th	6,380	6,340	6,260	6,470	6,750	7,130	7,520	8,380	1,549	-
10th	6,170	6,380	6,340	6,260	6,470	6,750	7,130	7,520	8,380	1,549
11th	5,980	6,170	6,380	6,340	6,260	6,470	6,750	7,130	7,520	8,380
12th	5,790	5,980	6,170	6,380	6,340	6,260	6,470	6,750	7,130	7,520
13th	5,660	5,790	5,980	6,170	6,380	6,340	6,260	6,470	6,750	7,130
14th	5,630	5,660	5,790	5,980	6,170	6,380	6,340	6,260	6,470	6,750
	5,720	5,630	5,660	5,790	5,980	6,170	6,380	6,340	6,260	6,470

Age Classes											Total Cut 10-Yr. Period
101-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190	191-200	200+	
6,267	6,268	6,267	6,268	5,216	5,217	1,051	1,051 122	2,101 2,101	2,102 2,102	4,055 4,055	8,380
3,115	6,267	6,268	6,267	6,268	5,216 323	5,217 5,217	1,051 1,051	929 929			7,520
3,115	3,115	6,267	6,268	6,267	6,268 2,237	4,893 4,893					7,130
5,217	3,115	3,115	6,267	6,268	6,267 2,719	4,031 4,031					6,750
5,216	5,217	3,115	3,115	6,267	6,268 2,922	3,548 3,548					6,470
6,268	5,216	5,217	3,115	3,115	6,267 2,914	3,346 3,346					6,260
6,267	6,268	5,216	5,217	3,115	3,115 2,987	3,353 3,353					6,340
-	6,267	6,268	5,216	5,217 3,137	3,115 3,115	128 128					6,380
-	-	6,267	6,268	5,216 4,090	2,080 2,080						6,170
-	-	-	6,267	6,268 4,854	1,126 1,126						5,980
1,549	-	-	-	6,267 4,376	1,414 1,414						5,790
8,380 2,220	1,549 1,549	-	-	-	1,891 1,891						5,660
7,520	6,160 5,630										5,630
7,130	7,520 5,190	530 530									5,720
6,750	7,130	2,330									

TABLE 7 - ALLOWABLE CUT CALCULATIONS
(Cont'd)

SPRUCE AND ALPINE FIR TYPE

KEMP FORMULA

$$Ac = \frac{1Ar + 3As + 5Ap + 7Am}{4R}$$

Ar = Restocking 0

As = Seedlings & saplings 0

Ap = Poles 486

Am = Sawtimber 7,978

Total 8,464

R = 120

$$\text{Annual cut area} = \frac{(1 \times 0) + (3 \times 0) + (5 \times 486) + (7 \times 7,978)}{4 \times 120}$$

$$= \frac{58,276}{480}$$

= 121 acres cut over annually

CALCULATION OF ALLOWABLE CUT BY SPECIES AND PRODUCTS

	Species						
	D	S	AF	LP	WBLP	ASPEN	TOTAL
				Sawtimber			
Stand per Acre (M b.m.)	0.356	6.675	0.307	1.146	0.178	-	8.662
Allowable Cut (M b.m.)	43	808	37	139	21	-	1,048
				Other Products			
Stand per Acre (cu. ft.)	11.6	195.5	223.2	224.1	53.5	4.3	712.2
Allowable Cut (M cu. ft.)	1.4	23.6	27.0	27.1	6.5	1.5	87.1
Allowable Cut (cords)	15	262	300	301	72	17	967

TABLE 7 - ALLOWABLE CUT CALCULATIONS
(Cont'd)

SPRUCE AND ALPINE FIR TYPE

AUSTRIAN FORMULA

$$Ac = I \pm \frac{Va - Vd}{R}$$

I = 75.2 x 8,464 = 636 M b.f.

Va = 70,111 M b.m.

R = 120

Vd = 20,042

Computation for Vd:

POOR SITE

Age	Normal Yield
20	-
40	30
60	50
80	2,530
100	9,050
120 ($\frac{1}{2}$)	8,640
Total	20,300

70% x 20,300 = 14,210

14,210 x 20 = 284,200

284,200 ÷ 120 = 2.368 M b.f.

2.368 x 8,464 = 20,042 M b.f.

$$Ac = 636 \pm \frac{70,111 - 20,042}{120}$$

$$= 636 + \frac{50,069}{120}$$

$$= 636 + 417$$

$$= 1,053 \text{ M b.f.}$$

TABLE 7 - ALLOWABLE CUT CALCULATIONS
(Cont'd)

SPRUCE AND ALPINE FIR TYPE

HANZLIK FORMULA

$$Ac = \frac{Vm}{R} + I$$

Vm = 69,106

R = 120

I = 486 x 75.2 = 36 M b.f.

$$Ac = \frac{69,106}{120} + 36$$

$$= 576 + 36$$

$$= 612 \text{ M b.f.}$$

SPRUCE-ALPINE FIR TYPE

ALLOWABLE ANNUAL CUT - 1,000 M

Current Age	Age When Cut	Area Acres	Stand per Acre	Total Volume	Years to Cut	
					Each	Cumulative
200+	200+	779	9.0	7,011	7	7
161-200	190	770	9.0	6,930	7	14
141-160	170	2,311	9.0	20,799	21	35
121-140	-	-	-	-	-	-
101-120	150	770	12.0	9,240	9	44
81-100	140	770	12.0	9,240	9	53
61- 80	130	1,532	15.0	22,980	23	86
41- 60	140	1,532	15.0	22,980	23	109
21- 40	-	-	-	-	-	-
0- 20	-	-	-	-	-	-

SPRUCE-ALPINE FIR TYPE - GALLATIN WORKING CIRCLE
PROGRESS OF REGULATION BY AREA BY APPLICATION OF KEMP FORMULA
BY TEN-YEAR PERIODS

Period	Age Classes									
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
1st	-	-	-	-	766	766	766	766	385	385
2nd	1,210	-	-	-	-	766	766	766	766	385
3rd	830	1,210	-	-	-	-	766	766	766	766
4th	900	830	1,210	-	-	-	-	766	766	766
5th	840	900	830	1,210	-	-	-	-	766	766
6th	820	840	900	830	1,210	-	-	-	-	766
7th	830	820	840	900	830	1,210	-	-	-	-
8th	700	830	820	840	900	830	1,210	-	-	-
9th	700	700	830	820	840	900	830	1,210	-	-
10th	700	700	700	830	820	840	900	830	1,210	-
11th	700	700	700	700	830	820	840	900	830	1,210 476
12th	700	700	700	700	700	830	820	840	900	830
	700	700	700	700	700	700	830	820	840	900

Age Classes									Total Cut 10-Year Period
101-110	111-120	121-130	131-140	141-150	151-160	161-180	181-200	200+	
385	385	-	-	1,155	1,155	385 55	385 385	770 770	1,210
385	385	385	-	-	1,155	1,155 500	330 330	-	830
385	385	385	385	-	-	1,155 245	655 655	-	900
766	385	385	385	385	-	-	910 840	-	840
766	766	385	385	385 365	385 385	-	-	70 70	820
766	766	766 40	385 385	385 385	20 20	-	-	-	830
766	766	766	726 700	-	-	-	-	-	700
-	766	766	766 674	26 26	-	-	-	-	700
-	-	766	766 608	92 92	-	-	-	-	700
-	-	-	766 542	158 158	-	-	-	-	700
-	-	-	-	224 224	-	-	-	-	700
734 700	-	-	-	-	-	-	-	-	700
830	34	-	-	-	-	-	-	-	

TIMBER HARVEST PLAN

ACCESS ROAD PLAN

No. on map	Location of timber to be sold	Planned cut by fiscal years, millions and decimals: 1960	1961	1962	1963	1964	Estimated non-N.F. timber hauled MM: Year	Amount	Description of road: number, name, and construction termini	Kind of work, etc.	Amount and kind of work, cost (thousands of dollars) and responsibility: FY 1960 Total	FY 1960 R-Reconst.	FY 1960 N-New const.	FY 1960 Respon.*	FY 1961 Total	FY 1961 R-Reconst.	FY 1961 N-New const.	FY 1961 Respon.*	FY 1962 Total	FY 1962 R-Reconst.	FY 1962 N-New const.	FY 1962 Respon.*	FY 1963 Total	FY 1963 R-Reconst.	FY 1963 N-New const.	FY 1963 Respon.*	FY 1964 Total	FY 1964 R-Reconst.	FY 1964 N-New const.	FY 1964 Respon.*	Status of: Surveys	Design	Rights-of-way	Notes
1	Sec 6, T4S, R6E Sec 31, T3S, R6E TOTAL SALE 1.5 MM LARCOMB	.7	.8						ROAD #3150 FROM A POINT 1.3 MILES FROM ROAD #3146 FOR 1.25 MILES INTO SEC 31, T3S, R6E SL-12	Length, miles Grading cost Surfacing cost Bridges cost Total cost			1.3 1.4 1.4	0 0 0																	Done	Done	None	
2	Secs 27, 28, T4S, R6E TOTAL SALE 3.0 MM BLACKMORE	.5	1.5	1.0					HISTORY ROCK ROAD #3153 FROM ACRD #62.1 TO BLACKMORE LAKE SL-12	Length, miles Grading cost Surfacing cost Bridges cost Total cost			2.0 0.0 0.0	0 0 0																	Done	Done	None	
3	Sec 7, [illegible], T3S, R7E TOTAL SALE 2.5 MM BEAR CANYON	1.0	1.5						NON-SYSTEM ROAD	Length, miles Grading cost Surfacing cost Bridges cost Total cost																								
4	Sec 6, T1S, R7E TOTAL 1 MM [illegible] PINE		.5	.5					SILVERMAN CREEK ROAD #3156 FROM FOREST HIGHWAY #40 TO [illegible], T4S, R7E SL-12	Length, miles Grading cost Surfacing cost Bridges cost Total cost					7		.3 0.4 0.4	FS FS FS													#2 0%	FIELD 0%	2 TO BE ACQUIRED	*R/W SHOULD BE ACQUIRED, TO LEAST LINE OF SEC 31, T4S, R6E ALTHOUGH THIS SALE WILL ONLY REQUIRE TO SEC 6, T5S, R7E. PURCHASE OF ADDITIONAL ROAD.
5	Sec 36, T1S, R6E * Sec 31, T1S, R7E TOTAL SALE 4.0 [illegible] MAN			1.0	1.0	1.0			SILVERMAN CREEK ROAD [illegible] FROM SEC 6, T1S, R7E TO ROAD #31[illegible].1 TO SEC 36, T1S, R6E. SL-14	Length, miles Grading cost Surfacing cost Bridges cost Total cost											1.0 3.0 4.0	C C C					#2 0%	FIELD 0%		
6	Sec 7, 2[illegible] 3E, T3S, R7E TOTAL SALE 4.5 MM BOZEMAN ALSA			.5	1.5	1.5			BOZEMAN CREEK ROAD #3[illegible].1 SL-14	Length, miles Grading cost Surfacing cost Bridges cost Total cost											.5 .5 1.0	0 0										SEE SHEET 2 OF PAR[illegible] CONCRETE TIED ROAD.
7	Sec 13, 14, 23, 24 & 25, T3S, R7E TOTAL SALE 5.0 MM GALLOP-PASS				1.0	4.0			FEL & BASIN LOOP ROAD #[illegible] FROM FOREST HIGHWAY #33 TO SEC 25, T3S, R5E SL-14	Length, miles Grading cost Surfacing cost Bridges cost Total cost															3.[illegible] 0.4 [illegible]	C 0			#2 [illegible]	FIELD 5%	TO BE ACQUIRED.	
										Length, miles Grading cost Surfacing cost Bridges cost Total cost																							
	[illegible] RELEASE [illegible] WALL SALE*	.	[illegible]	...	...	[illegible]				Length, miles Grading cost Surfacing cost Bridges cost Total cost																							
	TOTAL	3.2	5.3	5.[illegible]	4.5	4.[illegible]				Length, miles Grading cost Surfacing cost Bridges cost Total cost																							

Note: If a sale requires the construction of more than one road or if one road serves more than one sale, use one horizontal space across the form for each sale or each road involved.

Total cost must include all costs; engineering, grading, surfacing, and drainage facilities. Refer to form FS-118, line 26, column 2.

Refer to Road Handbook, page 628, paragraphs i and j, for definitions of "New construction" and "Reconstruction."

FOREST GALLATIN
WORKING CIRCLE GALLATIN (BOZEMAN BLOCK)
ALLOWABLE ANNUAL CUT - NF 11"+ = 3.3 MILLION BOARD FEET
11"- = 2.5 MILLION BOARD FEET

ACTUAL CUTS: NF	1954	1955	1956	1957	1958	
11"+	.853	1.680	1.218	1.298	1.012	MM BD. FT.
11"-	2.225	2.491	3.171	3.027	2.361	" " "
TOTAL	3.178	3.559	4.387	4.325	3.373	" " "

*Responsibility: FS - Forest Service
O - Operator
X - Explain any other responsibility in notes

Page 1 [illegible] OF INDICATED [illegible] EMPLOYMENT

Prepared by [illegible] Date [illegible]

Approved by [signature] Date [illegible]
Forest Supervisor

TIMBER HARVEST PLAN — ACCESS ROAD PLAN

No. on map	Location of timber to be sold	Planned cut by fiscal years, millions and decimals 1960	1961	1962	1963	1964	Estimated non-N.F. timber hauled MBM Year	Amount	Description of road: number, name, standard and construction termini	Kind of work, etc.	Amount and kind of work, cost (thousands of dollars) and responsibility — FY 1960 Total	FY 1960 R-Reconst.	FY 1960 N-New const.	FY 1960 Respon.*	FY 1961 Total	FY 1961 R-Reconst.	FY 1961 N-New const.	FY 1961 Respon.*	FY 1962 Total	FY 1962 R-Reconst.	FY 1962 N-New const.	FY 1962 Respon.*	FY 1963 Total	FY 1963 R-Reconst.	FY 1963 N-New const.	FY 1963 Respon.*	FY 1964 Total	FY 1964 R-Reconst.	FY 1964 N-New const.	FY 1964 Respon.*	Status of Surveys	Status of Design	Status of Rights-of-way	Notes
1	Sec 7, 8, 16, 18 and 19, T5S, R5E Total sale 14.3 MM Lime Creek	1.0	.5						Lime Creek Road #3105 to Sec 9 to SW¼ Section 19 T5S, R5E, SN-14	Length, miles																						
										Grading cost																						
										Surfacing cost	Under contract								Operation Construction													
										Bridges cost																						
										Total cost																						
2	Sec 11 & 12, T5S, R4E Total sale 2.6 MM Rat Lake #1	.1							Garrett Mtn. Road, #3112 to ¼ corner common to Sec 11 & 12, T5S, R4E SN-14	Length, miles																						
										Grading cost																						
										Surfacing cost	Under contract								Operation Construction													
										Bridges cost																						
										Total cost																						
3	Sec 17, 18, 19, 20, 29, and 30, T6S, R5E Total sale 31 MM Portal Creek	6.0	6.0	6.0	5.0				Road #584 Portal Creek from Highway #191 south to township line SN-14	Length, miles																						
										Grading cost																						
										Surfacing cost	Under contract								Contract Construction													
										Bridges cost																						
										Total cost																						
4	Sec 4, [illegible], 16 & 18 T4S, R5E Total sale 2.[illegible] MM Bear Creek #1	.5	.5						Bear Canyon Road #940 from county road to Cottonwood Divide SN-14	Length, miles																						
										Grading cost																						
										Surfacing cost	Under specific cooperative agreement with N. P.																					
										Bridges cost	Railway Co. Contract construction																					
										Total cost																						
5	Sec 4, [illegible], 16, [illegible], 22, & 24, T4S, R5E, & Secs 18 & 24, T4S, R4E Total sale 15 MM Bear Creek #2	4.0	5.0	5.0	4.[illegible]					Length, miles																						
										Grading cost																						
										Surfacing cost	Under specific cooperative agreement with N. P. Railway Company. Operation Construction																					
										Bridges cost																						
										Total cost																						
6	Sec 30, T4N, R5E Total sale 2.5 MM Mica Creek		1.5	1.0					Mica Creek Road #3128 from Road 132 to Sec 30, T4S, R5E SN-14	Length, miles									1.0	0					1.5	0					#2	[illegible]	[illegible]	[illegible]
										Grading cost									3.4	0					0.5	0					DE			
										Surfacing cost																								
										Bridges cost																								
										Total cost									5.0						2.0	0							
7	Secs 2, 10, 12, 14, T5S R5E, and in Secs 6, 8, 16, 18 & 20, T5S, R5E Total sale 3.[illegible] MM Upper Squaw Creek	1.8		1.0	2.0	2.0			Squaw Creek Road #132 from 3105 for 2 miles SN-14	Length, miles									1.0	0					1.0	0					#1 DE	Office DE	1 TC accessible (4 acres) 1 mile
										Grading cost									14.3	0					14.3	0							
										Surfacing cost																								
										Bridges cost																								
										Total cost									15.[illegible]						15.3	0							
									Squaw Creek Road #498 from east line of Sec 28 to east line of Sec 26, T5S, R5E. SN-14	Length, miles													1.5	0					#1 DE	Office DE	1 TC accessible (5 acres) [illegible] mile	[illegible]
										Grading cost															21.[illegible]	0							
										Surfacing cost																								
	Upper Squaw				.5	1.5				Bridges cost																								
										Total cost															21.4	0							
3a									Road #2699 from Road #498 to east line of Sec 3, T5S, R5E. SN-14	Length, miles																			2.5	0	#2 DE	Field DE	6 TC accessible [illegible]
										Grading cost																			23	0			
										Surfacing cost																								
										Bridges cost																								
										Total cost																			23	0			
3	Sec 31, [illegible] 36, T4S, [illegible] Total sale 1.0 MM West Creek				.5	.5			Non-system road	Length, miles																						
										Grading cost																						
										Surfacing cost																						
										Bridges cost																						
										Total cost																						

Page 1

Note: If a sale requires the construction of more than one road or if one road serves more than one sale, use one horizontal space across the form for each sale or each road involved.

Total cost must include all costs; engineering, grading, surfacing, and drainage facilities. Refer to form FS-118, line 26, column 2.

Refer to Road Handbook, page 628, paragraphs i and j, for definitions of "New construction" and "Reconstruction."

Forest Gallatin
Working Circle Gallatin (Gallatin Block)
Allowable Annual Cut — BF 11"- 9.3 Million Board Feet
11"- 7.2 Million Board Feet

Actual Cut	1954	1955	1956	1957	1958	
BF 11"-	2.708	2.381	2.873	3.466	1.808	MM Bd. Ft.
11"-	4.317	5.508	6.037	8.086	4.217	" " "
Total	7.025	7.889	8.910	11.552	6.025	" " "

*Responsibility: FS - Forest Service
O - Operator
X - Explain any other responsibility in notes

Prepared by [illegible] Date [illegible]

Approved by [signature] Date 2/20/59
Forest Supervisor

TIMBER HARVEST PLAN

ACCESS ROAD PLAN

No. on map	Location of timber to be sold	Planned cut by fiscal years, millions and decimals					Estimated non-N.F. timber hauled MM		Description of road: number, name, standerd and construction termini	Kind of work, etc.	Amount and kind of work, cost (thousands of dollars) and responsibility																Statue of			Notes
											FY 1960				FY 1961				FY 1962				FY 1963				FY 1964						
		19 60	19 61	19 62	19 63	19 64	Year	Amount			Total	R-Reconst.	N-New const.	Respon. *	Total	R-Reconst.	N-New const.	Respon. *	Total	R-Reconst.	N-New const.	Respon. *	Total	R-Reconst.	N-New const.	Respon. *	Total	R-Reconst.	N-New const.	Respon. *	Surveys	Design	Rights-of-way	
10	Sec 34, T4S, R5E Total sale 3 MM Smith Creek				.3	.5			Non-system road	Length, miles Grading cost Surfacing coet Bridges cost Total cost																					
11	Sec 22, 24, 26, T7S, R4E Sec 30 & 32, T7S, R5E Total sale 3 MM Porcupine Creek				3.3	3.3			Porcupine Creek road #492 from Highway #191 to Sec 30, T7S, R5E SA-14	Length, miles Grading cost Surfacing cost Bridges cost Total cost													2.5 23 23	F F			2.5 23 23	F F	#1 0%	Office 0%	1 to acquire from N.F.	
12	Secs 18, 20, 24, 30, T6S, R3E Sec 24, T6S, R2E Total sale 5 MM West Fork					3.0			Road #166 West Fork from Sec 27, T6S, R3E to NW corner of Sec 15, T6S, R3E SA-14	Length, miles Grading cost Surfacing cost Bridges cost Total cost																			1.9 9.4 9.4	C 0 0	None or Less	None or Less	1 to acquire from Consolidated Timber Company	Present R/W problems. Access planned for first 3 miles of road from Highway #191
										Length, miles Grading cost Surfacing cost Bridges cost Total cost																					
										Length, miles Grading cost Surfacing coet Bridges cost Total cost																					
13	Miscellaneous small sales from existing roads	1.0	1.0	1.0	1.0	1.0				Length, miles Grading cost Surfacing cost Bridges cost Total cost																					
										Length, miles Grading cost Surfacing cost Bridges cost Total cost																					
										Length, miles Grading cost Surfacing cost Bridges cost Total cost																					
										Length, miles Grading cost Surfacing cost Bridges cost Total cost																					
										Length, miles Grading cost Surfacing cost Bridges cost Total cost																					
	Total	8.6	15.0	16.0	16.6	9.3																										

Page 2

Note: If a sale requires the construction of more than one road or if one road serves more than one sale, use one horizontal space across the form for each sale or each road involved.

Total cost must include all costs; engineering, grading, surfacing, and drainage facilities. Refer to form FS-118, line 26, column 2.

Refer to Road Handbook, page 628, paragraphs i and j, for definitions of "New construction" and "Reconstruction."

Forest Flathead
Working circle Kalispell (Kalispell Unit)
Allowable annual cut - NF See page #1 million board feet

Actual cut:	19	19	19	19	19
NF	See page #1				
Other					

Prepared by See page #1 Date

Approved by E. K. Truesdale Date 4-20-59
Forest Supervisor

*Responsibility: FS - Forest Service
O - Operator
X - Explain any other responsibility in notes

TIMBER HARVEST PLAN

No. on map	Location of timber to be sold	Planned cut by fiscal years, millions and decimals 1960	1961	1962	1963	1964	Estimated non-N.F. timber hauled MM Year	Amount
1	Secs 20 [illegible] 21, T12N, R5E Total sale [illegible] MM Collar Creek	1.3						
2	Secs 15, 16, 17, 20, 21, 22, 27, 28, 29 & 32 T14S, R5E Total sale [illegible] MM South Plateau	4.0	6.0	6.0	2.0			
3	Secs 22 [illegible] 27, T13S, R4E Total sale 3 MM Butlermilk		1.5	1.5				
4	Secs [illegible] 4, 22, 27 & 28 T13S, R5E Total sale 3 MM Airport	3.0						
5	Secs [illegible], 16, 17, 19, 20 & 21, T13S, R4E Total sale 4.0 MM (Clear-cut) West Fork Denny Creek	1.0						
6	Secs 3, T11S, R3E Sec 33, 34, 27 & 28 T10S, R3 Total sale 7 MM Beaver Creek		.5	2.0	2.0	2.0		
7	Secs 27, 28, 32 & 33 T13S, R4E Total sale 6 MM East Fork Denny Creek			1.0	2.0	3.0		
	Sec 35, T11S, R3E Sec 1, 2, 11, 12, 13, 24, 25, T12S, R3E. Sec 18, 19, 30, 31 & 32, T12S, R4E Total sale 12 MM Cotany - Trapper					2.0		
	Miscellaneous small sales	1.0	1.0	1.0	1.0	1.0		
	TOTAL	10.3	9.0	11.5	7.0	7.0		

Note: If a sale requires the construction of more than one road or if one road serves more than one sale, use one horizontal space across the form for each sale or each road involved.

Total cost must include all costs; engineering, grading, surfacing, and drainage facilities. Refer to form FS-118, line 26, column 2.

Refer to Road Handbook, page 628, paragraphs i and j, for definitions of "New construction" and "Reconstruction."

ACCESS ROAD PLAN

No. on map	Description of road: number, name, standard and construction termini	Kind of work, etc.	Amount and kind of work, cost (thousands of dollars) and responsibility — FY 1960 Total	FY 1960 R-Reconst.	FY 1960 N-New const.	FY 1960 Respon. *	FY 1961 Total	FY 1961 R-Reconst.	FY 1961 N-New const.	FY 1961 Respon. *	FY 1962 Total	FY 1962 R-Reconst.	FY 1962 N-New const.	FY 1962 Respon. *	FY 1963 Total	FY 1963 R-Reconst.	FY 1963 N-New const.	FY 1963 Respon. *	FY 1964 Total	FY 1964 R-Reconst.	FY 1964 N-New const.	FY 1964 Respon. *	Status of Surveys *	Design *	Rights-of-way	Notes
1	Road [illegible] from Highway #151 for 1.3 miles SL-12	Length, miles				Operator contr.																	Done	—	Not
		Grading cost																								
		Surfacing cost																								
		Bridges cost																								
		Total cost																								
2	Road #1710 South Plateau from [illegible] Sec 33, T13S, R5E, to [illegible] Sec 2, T14S, R5E. SL-14	Length, miles			2.5	0			2.0	0			.5	0									Done	Done	None	
		Grading cost			95.7	0			118	0			4.2	0												
		Surfacing cost																								
		Bridges cost																								
		Total cost			95.7	0			118	0			4.7	0												
3	Butlermilk Road #1718 from Highway #46 in Sec 21, T13S, R4E to Cream Creek Road #987 SL-14	Length, miles							1.5	0													[illegible]	Field [illegible]	None	
		Grading cost							14	0																
		Surfacing cost																								
		Bridges cost																								
		Total cost							14	0																
4	From existing roads	Length, miles																								
		Grading cost																								
		Surfacing cost																								
		Bridges cost																								
		Total cost																								
5	Non-System Road	Length, miles																								
		Grading cost																								
		Surfacing cost																								
		Bridges cost																								
		Total cost																								
6	Wapiti Road #3522.2 from Road #985.1 to Sec 33, T10S, R3E SL-14	Length, miles							1.5	0													[illegible]	Field [illegible]	None	
		Grading cost							14	0																
		Surfacing cost																								
		Bridges cost																								
		Total cost							14	0																
7	Continental Divide Road #1725 from Highway #46 to Sec 33, T13S, R4E SL-14	Length, miles											2.5	0									[illegible]	Field [illegible]	None	
		Grading cost											23	0												
		Surfacing cost																								
		Bridges cost																								
		Total cost											23	0												
	Sec 35, T11S, R3E Sec 1, 2, 11, 12, 13, 24, 25, T12S, R3E. Sec 18, 19, 30, 31 & 32, T12S, R4E Total sale 12 MM Cotany - Trapper	Length, miles																			—		[illegible]	Office	None	[illegible] as Trails.
		Grading cost																								
		Surfacing cost																								
		Bridges cost																								
		Total cost																								
	Miscellaneous small sales	Length, miles																								
		Grading cost																								
		Surfacing cost																								
		Bridges cost																								
		Total cost																								
		Length, miles																								
		Grading cost																								
		Surfacing cost																								
		Bridges cost																								
		Total cost																								

Forest Gallatin
Working Circle Gallatin (Hebgen Block)
Allowable annual cut — MF 11"+ = 7.0 Million board feet
11"- = 6.3 Million board feet

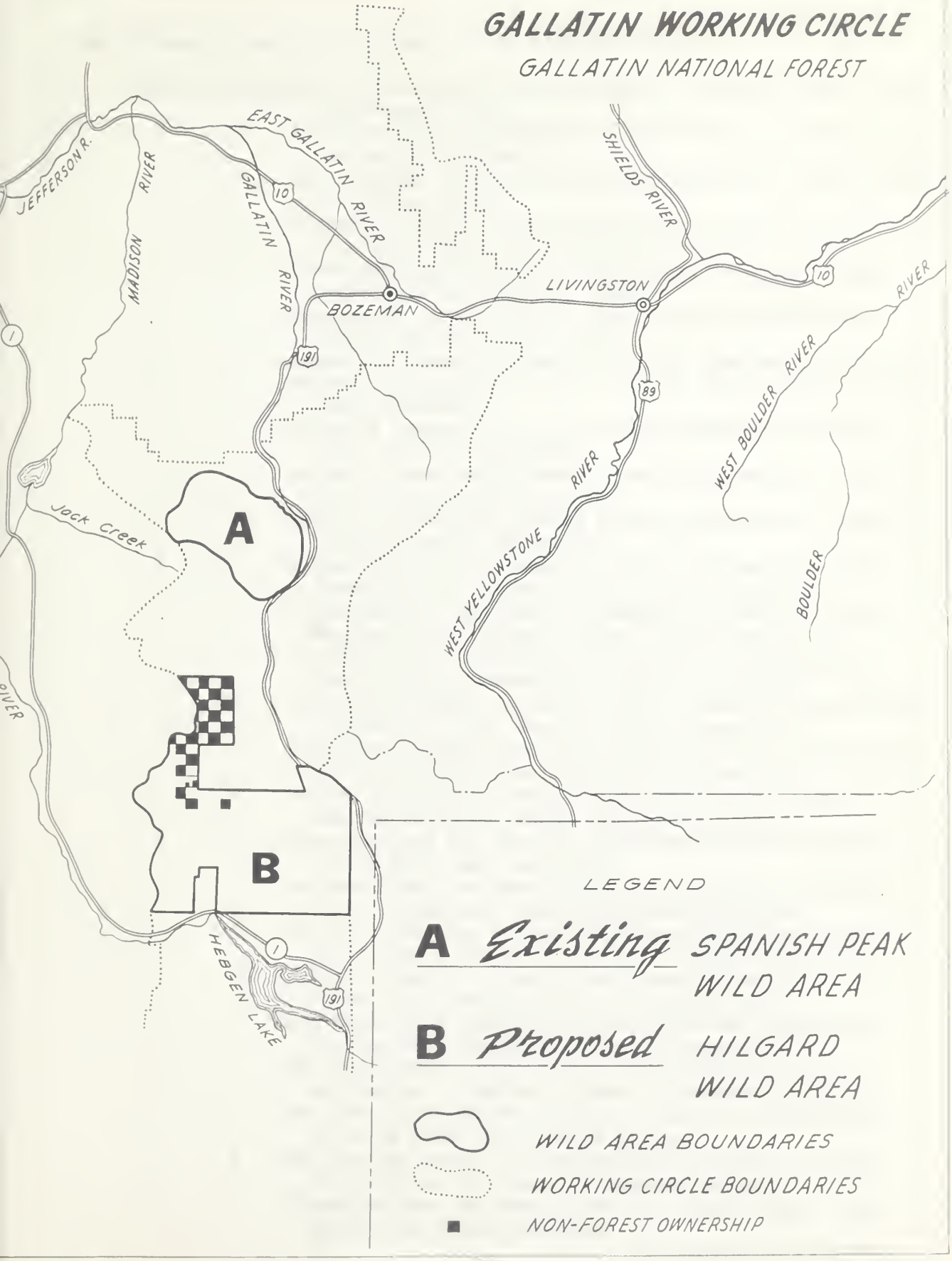
Actual cut		1954	1955	1956	1957	1958	
	MF 11"+	.653	.731	.807	.572	1.026	MM bd. ft.
	11"-	1.522	1.704	2.116	1.335	2.395	" " "
	Total	2.175	2.435	3.023	1.907	3.421	" " "

*Responsibility: FS - Forest Service
O - Operator
X - Explain any other responsibility in notes

[illegible] of action [illegible] implement

Prepared by [illegible] Date [illegible]

Approved by [illegible] Date [illegible]
Forest Supervisor


GALLATIN WORKING CIRCLE
GALLATIN NATIONAL FOREST
JEFFERSON R.
MADISON RIVER
EAST GALLATIN RIVER
GALLATIN RIVER
10
SHIELDS RIVER
BOZEMAN
LIVINGSTON
191
89
WEST BOULDER RIVER
WEST YELLOWSTONE RIVER
BOULDER
RIVER
Jack Creek
A
B
HEBGEN LAKE
LEGEND
A Existing SPANISH PEAK WILD AREA
B Proposed HILGARD WILD AREA
WILD AREA BOUNDARIES
WORKING CIRCLE BOUNDARIES
NON-FOREST OWNERSHIP


A
B

The following from the original are not reproduced here:

Table showing Land Area by Ownership and Major Classes of Forest Land for Bozeman Block
" " Land Area by Ownership and Major Classes of Forest Land for Gallatin Block
" " Land Area by Ownership and Major Classes of Forest Land for Hebgen Block
" " Commercial Forest Land by Ownership, Type, and Stand-Size Class for Bozeman Block
" " Commercial Forest Land by Ownership, Type, and Stand-Size Class for Gallatin Block
" " Commercial Forest Land by Ownership, Type, and Stand-Size Class for Hebgen Block
" " Acres of Commercial Forest Areas by Ownership and Strata
" " Acres of Commercial Forest Areas by Strata and Blocks - State Ownership
" " Acres of Commercial Forest Areas by Strata and Blocks - Large Private Ownership
" " Acres of Commercial Forest Areas by Strata and Blocks - Other Private Ownership
" " Acres of Commercial Forest Areas by Strata and Blocks - National Forest Ownership
" " Volume of Live Sawtimber by Species, Stand Size, and Ownership for Bozeman Block (M b.f. Scribner)
" " Volume of Live Sawtimber by Species, Stand Size, and Ownership for Gallatin Block (M b.f. Scribner)
" " Volume of Live Sawtimber by Species, Stand Size, and Ownership for Hebgen Block (M b.f. Scribner)
" " Volume of Primary Growing Stock by Species, Stand Size, and Ownership for Bozeman Block (M cu. ft.)
" " Volume of Primary Growing Stock by Species, Stand Size, and Ownership for Gallatin Block (M cu. ft.)
" " Volume of Primary Growing Stock by Species, Stand Size, and Ownership for Hebgen Block (M cu. ft.)
" " Average Stand Per Acre of Sawtimber Stands by Species, Forest Type, and Ownership
" " Average Stand Per Acre of Sawtimber Stands by Species, Forest Type, and Ownership of Bozeman Block
" " Average Stand Per Acre of Sawtimber Stands by Species, Forest Type, and Ownership of Gallatin Block
" " Average Stand Per Acre of Sawtimber Stands by Species, Forest Type, and Ownership of Hebgen Block
" " Net Board Foot Volumes by Stratification, Stand Size, and Species - National Forest Nonreserved
" " Net Cubic Foot Volume by Stratification, Stand Size, and Species - National Forest Nonreserved
" " Net Board Foot Volume Per Acre - Based on 1464 Survey Plots in Block 2 - Eastern Montana
" " Net Partial Cubic Foot Volume Per Acre Based on 1466 Survey Plots in Block 2 - Eastern Montana
" " Stand Per Acre by Stratification - Hebgen Block - Net Board Feet Volume Scribner

(Continued next page)

(Materials not repoduced continued)

Table showing Stand Per Acre by Stratification - Hebgen Block - Net Partial Cubic Foot Volume Per Acre
" " Site Table - Bozeman Block
" " " " - Gallatin Block
" " " " - Hebgen Block
" " Usable Cull and Salvage Volumes - Bozeman and Gallatin Blocks
" " Usable Cull and Salvage Volumes for Hebgen Block
Regional Marking Guides for Douglas-fir, Engelmann Spruce-Alpine Fir, and Lodgepole Pine Types
Map showing Ownership Pattern
" " Forest Types
" " Compartments